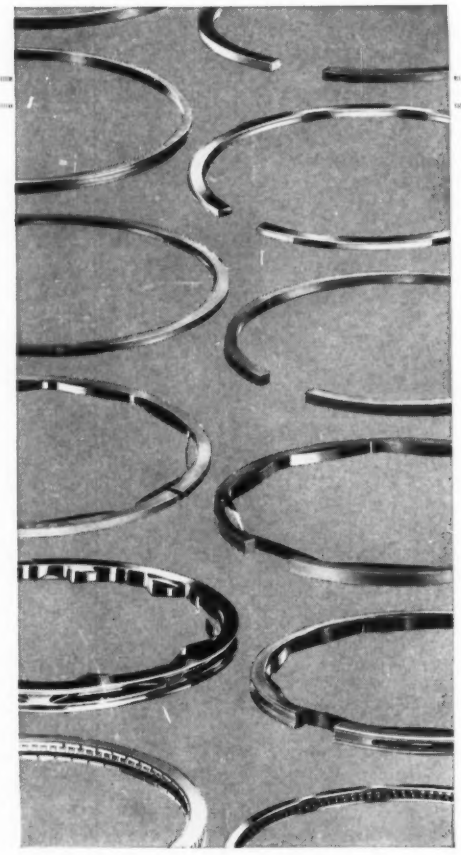
Automotive Service Digest

Our 48th year

January, 1960

Crankshaft journal reconditioning—See page 14

What does *Dependability* mean to you?



When a set of rings is installed in an engine, at least two people are interested in what happens: the installing mechanic, and the operator. To us, DEPENDABILITY means that neither of them is disappointed.

Perfect Circle builds dependability into each ring set in these ways:

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By scientific selection of materials for maximum performance in specific ring grooves.

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FORM-A-GASKET NO. 1 With Special Spreader Cap	Paste	Fast	Hard	Permanent assemblies; broken gaskets and fittings; building up uneven and warped surfaces; sealing damaged thread connections; replacement of unavailable gaskets.	Withstands heat and pressures up to 5000 lbs./sq. inch, during continuous service.
FORM-A-GASKET NO. 2 With Special Spreader Cap	Paste	Slow	Pliable	For reassembly work where adjustments or disassemblies are likely. Ideal for cover plates, threaded and hose connections, and preservation of all types of solid gaskets.	Perfect seal, allows disassembly without damage even after subjection to heat, pressure and long use. For pressures up to 5000 lbs./sq. in.
AVIATION FORM-A-GASKET NO. 3	Brushable liquid	Medium	Tacky	Lubricates close-fitting parts for easy assembly, and keeps seal tight, corrosion-free, yet allows easy disassembly.	Won't run at high temperatures or become brittle at sub-zero temperatures. Resists pressures up to 5000 lbs./sq. in.
SUPER "300" FORM-A-GASKET	Brushable, heavy-bodied liquid	Slow	Firm	For assembly work on newer high compression engines and milled heads, diesel heads, cover plates and transmission housings.	Diester resistant. Resists "washing" action of detergent additives for auto lubricants and aviation jet fuels. Pressures to 6000 lbs./sq. in.
STICK-N-SEAL	Full-bodied liquid of Buna-N type synthetic rubber	Fast	Tacky	Holds gaskets or other material in place for easy assembly and eliminates "delayed action" leaks after job is done.	Combines outstanding initial tackiness with resistance to gasoline, oils, water, glycol, kerosene. Unaffected by lubricants which dissolve ordinary rubber cements.

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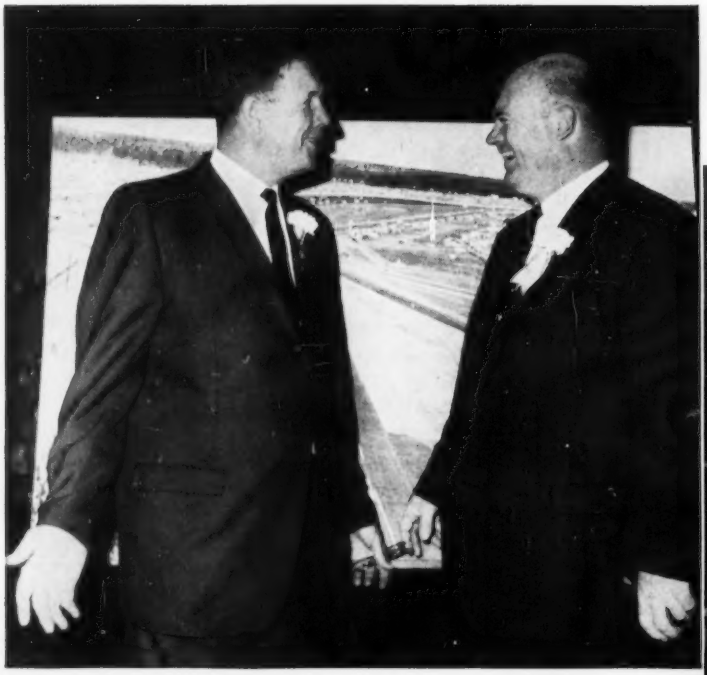
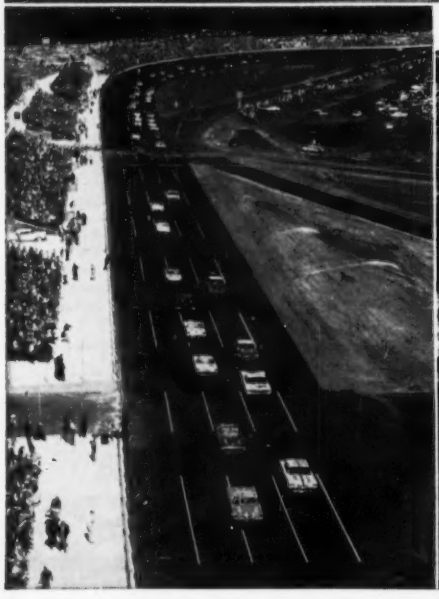
NASCAR



Mr. William H. G. France, NASCAR president, and Mr. Robert H. Davies, Autolite president, discuss plans for the Autolite NASCAR program.



Late model stocks roar around north side of the high-banked Daytona International Speedway. The pit access road is shown at the right along with telesign and garage area.

Aerial view of the three-million-dollar two-and-a-half-mile Daytona International Speedway, showing 45-acre lake in center of the infield with Municipal airport in background. The track has already been established as the world's fastest with new record speeds for stock cars, speedway cars and sports cars.

WELCOMES AUTOLITE

Sensational photo finish of the 500-mile NASCAR International Sweepstakes race at Daytona International Speedway, February 22, 1959, showing how Car No. 42 nosed out Car No. 73. Car No. 48 was a lap behind at the finish.

Autolite will participate in the Daytona Speed Weeks and at NASCAR sanctioned events throughout the country

Here's the biggest promotional boost yet for Autolite Spark Plug Dealers everywhere! Now Autolite Spark Plug Dealers will be able to capitalize on the intense excitement and interest generated by a sport that attracts more spectators than professional baseball, including the World Series.

Autolite will begin active participation in NASCAR with the 11th Annual NASCAR Safety and Performance Trials and the 2nd Annual Daytona International Speedway Winter Classics, January 30 through February 14. Autolite will participate in all NASCAR activities at Daytona Beach, Florida, and at NASCAR sanctioned events across the nation. In the limelight will be cars equipped with Autolite Spark Plugs.

Autolite NASCAR prizes, plus a series of special regional trophies, will dramatize the leadership of Autolite Spark Plugs in 1960 and for years to come. And with each award the Autolite Spark Plug Dealer can be sure that Autolite NASCAR participation is building sales for him!

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January 1960

Automotive Service Digest

Cover Subject

With the crankshaft in or out of the engine, miking the crankpin journals for out-of-roundness and taper is the preliminary step in reconditioning them.

Articles

14 Crankshaft journal reconditioning
20 Servicing the Austin-Healy Sprite
26 Ignition ballast resistors
33 Mayhem in the mill
38 The transistor
40 Switches in motor cars

Features

6 Automotive clinic
10 Spokes from the "hub"
13 The Editor's page
44 New products
56 Trade literature
57 Calendar of automotive events
59 Refresher course

Technical help for the service shop

Tech Know-How **articles cover how-to and what's new in approved, up-to-date shop practices, as seen and understood by men experienced in the trade.** ***Business Know-How,*** **the dollar-sign side of automotive service work;** ***Service Education,*** **the who-what-where-how of today's trade training.**

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Automotive clinic

Stuck on some problem? Need help on a job? Write us about your problem on your SHOP LETTERHEAD to insure receiving the information you are looking for. The Automotive Clinic is exclusively conducted for shop operators and others actively in the automotive service business.

Address your letter to Automotive Clinic c/o AUTOMOTIVE SERVICE DIGEST, 900 So. Wabash Ave., Chicago 5, Ill.

Ben Ikert, Editor

Leaky Transmissions

We have owned two Army Jeeps since 1945 which we use for delivery service. In all these years we have never been able to stop the transmissions from leaking, even though they have been rebuilt and exchanged. Various shops have tried to overcome this problem, but without luck. Can you suggest a cure?

—J.I., Hollywood, Calif.

Answer: When the rear bearing cap assembly is installed, check the end movement of mainshaft, which determines the adjustment of the tapered roller bearings. The end play should be .004" to .008". The adjustment is made by the selective installation of shims (.003", .010", or .031") between cap and case. Do not install rear cap seal until the bearings are properly adjusted.

Be sure that exactly the right seals are used, that they are properly put in and that the bearings are properly adjusted. Perhaps using a non-drying type gasket compound around the seals on installation might help.

Troublesome Overdrive

The overdrive of a 1958 Ford Six will not engage when the temperature falls below 75°—it just free wheels. In addition, this car, as well as other 1958 manual transmission Fords, shifts rough at this temperature.

I have tried using an additive in the transmission oil to thin it out, but this doesn't help. Everything else checks out OK when transmission is warm.

—W.E.P., Fox Lake, Ill.

Answer: When the overdrive does not engage when temperature falls below 75°F, the first thing to do is to see whether the trouble is electrical or mechanical. When overdrive handle is pushed all the way in there should be ¼" clearance between the handle shank and support bracket on dash.

Next raise car and check position of overdrive control lever at overdrive housing. It should be firmly against stop at rear. If not, overdrive shift rail may be blocking the pawl so it cannot engage balk ring gear.

With engine off and clutch engaged, shift transmission into high or second and shift overdrive into auto position (rear). Driveshaft should turn freely clockwise (from front) but should lock up if turned counterclockwise. Check engagement of pawl with balk ring gear. Turn driveshaft counterclockwise (from front) and at same time ground white governor wire with a jumper. This energizes the solenoid and solenoid stem should move in about ⅛". Solenoid plunger should move in about ½".

Keep solenoid engaged and shift the transmission into second or high to lock transmission output shaft against rotation. Shift OD into auto position (rear). Again turn driveshaft CW and observe action of solenoid stem. At no more than ¼ turn the solenoid stem should move in approximately ⅜", indicating that the pawl has engaged the balk ring gear.

If the pawl engages balk ring gear the driveshaft will be locked against rotation in either direction. If pawl does not engage the balk ring gear, install a new solenoid and repeat test. Now if the pawl does not engage, the overdrive must be removed from car for repair.

WHEN CHANGING YOUR ADDRESS

Please notify us 5 weeks in advance. Supply us with both your old and new address, including address label from current issue if possible. Copies we mail to your old address will not be delivered by the Post Office unless you pay them extra postage. Mail address changes to Circulation Dept., Automotive Service Digest, 900 South Wabash Ave., Chicago 5, Ill.

Hard Starting

In connection with the inquiry from E.E.L., East Brunswick, N.J., published in our November, 1959 issue regarding hard starting of a '51 Cadillac, when warm, we have received the following comments offering possible solutions. If other readers have a solution, let's have them.

From M.G.M., New Orleans, La. I take exception to the answer to the hard starting problem of a 1951 Cadillac in your November issue.

This problem "is" chronic with this particular car, and I can cite many examples to prove it. I have talked to any number of car owners and shop operators who have encountered the same problem. There are many in this area who have installed an 8-volt battery to correct the problem, but it has been to no avail. It has helped in some cases.

We attack the problem, and have been quite successful, by cleaning or replacing, if necessary, the valve lifters. This, of course, is done only after all conventional checks have been made.

From C.McA., Prince George, B.C. I ran into a similar problem and cured it successfully by re-locating the battery as close to the starter as possible. I then take the ground strap and fasten it to the mounting bolt of the starter, after making sure all connections are clean.

From J.W., Kingsville, Texas. Tell E.E.L. to put an 8-volt battery in and set up the regulator. This will solve his problem.

Double Talk

On page 34 of your October, 1959 issue, under the heading "Don't Throw Away Good Plugs," Electric Autolite warns of the fallacy of testing resistor spark plugs with a low voltage ohmmeter.

On page 71 of the same issue, under "Testing Resistor Plugs" it is stated that the only way a resistor plug, with a bad resistor unit, can be checked is with an ohmmeter. These statements are both positive, and in direct contradiction with each other.

I realize that the information contained in these two statements may have come from two different sources, but with our field already overbur-

(Continued on page 8)

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Automotive Clinic...

(Continued from page 6)

dened with gimmicks, gadgets, misinformation and a general lack of information, such discrepancies in a technical publication tend to annoy and confuse the mechanic and destroy his trust and confidence in the source of the information.

—L.T.O., Miami, Fla.

Answer: While the statements do sound rather contradictory, and the two articles were written from different view points, the Autolite article referred to plugs that are in reasonably good condition and could be used; the Ohmmeter article referred to plugs that have given trouble and the ohmmeter test will determine whether the resistor is open or not, or has excessive resistance.

From the experience and background indicated by your letter, you can readily appreciate these two angles, though it was not made too clear in the articles referred to. We both know that when a spark plug is open, even though a spark will jump across the gap, that it is not a good plug to use. A normal plug with not over 15,000 to 20,000 resistance will still give continuity of current flow, while if the resistance is higher it will not perform as it should and if it is open, the plug should not be used. We consider that none of the high tension tests on plugs are very exact or even accurate, being indicative only. The final test of a plug is how it acts in the engine.

Axle Shaft Torque

We all know that a differential's main purpose is to allow one wheel to travel faster than the other when turning a corner. The speed loss of one side axle gear is transferred to the other gear, thereby increasing the speed. If the horsepower is held constant at the pinion driveshaft (neglect friction), there is a torque multiplication through the ring gear and a speed loss, but power should be unchanged. The power should also split 50-50 to each axle.

If there is a power split and one axle speed is greater than the other, it would seem to me that the torque to each wheel would change in proportion to the speed increase or decrease, as torque times r.p.m. equals power. I feel there must be a changing pivot point as the differential pinions walk around the side axle gears. This changing pivot would account for a change in torque. Example: If the one axle were held stationary, the differential pinion gear would pivot on the stationary side axle gear and all

(Continued on page 42)

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BY HERB CARRIER
Detroit Editor

Spokes from the "hub"

• APPRENTICESHIP FOR MECHANICS is getting closer. The independent Garage Owners of America are working hard at sponsoring an accredited course for training mechanics. IGO-Ohio is extremely active in this area. The program as outlined seems to be the only **true** answer to the present mechanic situation. It appears that the service industry must face up to the task of developing their own mechanics. More power to the IGO. It's encouraging to see an independent organization making real progress in solving a problem that has befuddled the entire automotive industry for years.

* * *

More Aluminum entered passenger car use recently. Regular aluminum foil was an emergency "fix" for a carburetor icing problem on one of the new compact cars. Reportedly, the aluminum foil was to be wrapped around the carburetor heat tube. The insulating quality of the foil helped protect the exhaust gases in the heat tube from the icy blasts of air induced by the engine's fan. Taking the chill off the heat tube helped to warm up the carburetor so that excessive icing wouldn't be too big a problem. Ah, the marvels of modern automotive engineering.

* * *

Two things aren't dead. One of them is air suspension. The other is king-pin suspension. These two "passe" systems are merely suspended. Reports have it that both are slated for eventual return to mass production. It's hard to visualize a return to king-pins, but apparently new methods have been developed which enable this type of suspension to rival power steering for ease and accuracy. And air bags seem to be all set for another "go round", but this time they are de-bugged and have tremendous advantages over steel springs.

* * *

Smog News. The smog problem seems like it is close to being whipped. At least the possible contributions of the automobile to the general smog picture may be curtailed. Several new devices have been introduced that do a remarkably good job of reducing smog-causing emissions from an engine's exhaust. Latest smog newsmaker is a device developed by an 80 year old Arizona inventor. Mr. Fred Roland claims his little gadget could solve the Los Angeles smog problem and double the gas mileage at the same time. Roland admits his product is basically a carburetor attachment that could be produced for about $25, but past that "he ain't talking".

* * *

Sixes and sticks are gaining in buyer acceptance. An ever increasing number of new car buyers are ordering vehicles equipped with six cylinder engines and standard transmissions. This fact, say the experts, points to the ever increasing demand for more and more economy. Some go so far as to say "economy is the watchword for '60".

Unfortunately, the economy kick might have very unfavorable side effects. For example, people in the petroleum industry point out the fact that tax dollars from the sale of retail gasoline are absolutely necessary for maintenance of existing roads and building of new ones. With people demanding cars that use less gasoline to travel more miles, there will be greater demands for more roads but less tax dollars with which to build them. The obvious result is that gasoline taxes will be **raised** to make up the deficit.

The end result is that the American people will be squeezed into a small foreign type automobile in their search for operating economy, But they will be paying much more money for a gallon of gasoline. A situation could develop where the cost-per-mile of driving would remain about the same as it is today, but the tax per gallon of gasoline would be excessivly high; and our "standard of transportation" reduced to that of middle Europe.

Could it be that those who buy cars for "economy of operation", but who want expensive highways on which to run them, are actually trying to avoid their fair share of the cost of modern highways and, consequently, are actually throwing a monkey wrench into the progress that has made us the "best wheeled" nation on earth?

If this is true, the same people could be undermining the automotive service picture. They are probably the same people who spend a fortune maintaining television sets and automatic home laundries, but squeal to high heaven at the cost of a motor tune-up.

"Cheap" cars could have very serious effects on our American way of life. Let's hope they are just a passing fancy, and we will continue to have economical mass transportation on a scale to which we have grown accustomed.

* * *

The "forgotten four" are emphasized at AC Spark Plug division as four common service items too often overlooked in cold weather by shops, let alone car owners.

What are these four? Answer is, the crankcase breather, gas line filter, oil filter and the spark plugs. Most of 'em are taken pretty much for granted, unless trouble ensues. This is particularly true of the crankcase breather, points out AC. A plugged crankcase breather makes the sludge problem more severe because it traps blow-by gases in the engine.

Gas line filters can shut off fuel flow because of dust, dirt or other foreign matter. Since cold oil is thicker than hot oil, AC says the by-pass valve in a partially clogged filter may be forced open and unfiltered oil lubricates the engine, hastening sludge formation.

Spark plugs run cooler in cold weather and a fouled plug or one too widely gapped misfires more easily.

Surely this quartet of service items should offer no particular know-how problems to mechanics as to corrective measures that have to be applied. Main thing AC stresses is these things can be more troublesome in those parts of the country where frigid weather prevails.

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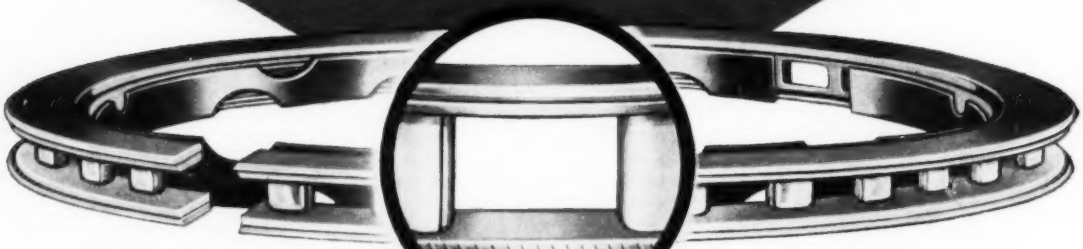

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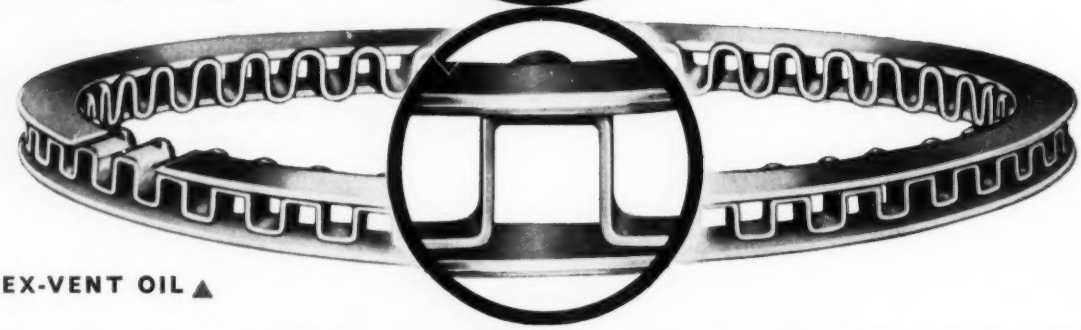

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Editor's page

Taking the compacts in stride

• A COMPLETELY NEW design of any machines — automobiles or otherwise — almost always complicates the task of keeping them performing up to expectations of buyers.

The factory has its problems of materials, production, quality control, timing, selling, sales and service training, service manuals, bulletins, special tools and equipment — countless other things.

Months before launching into the market with a new car the maker must plan for its servicing and repair in the field. Hand built test cars, if they can be corralled long enough by the service gentry, point up new procedures and tool requirements for new parts. Such tools service shops, garages and similar outlets must buy and their mechanics must learn their correct use.

For some time GM, Ford and Chrysler have been operating training courses for the servicing of their all-new cars—Corvair, Falcon and Valiant. These programs are more complex than formerly, since the compact cars are really all new from the ground up. No parts are said to be interchangeable with other models in the same make line. No parts are carried over from previous year models. Fact is, there are no previous year models of the Corvair, Falcon or Valiant.

What about the independent garageman, the station with mechanics on duty, and others who will be involved in the inevitable job of repairing the new compact cars, or any of the new cars for that matter?

It's a safe bet that the compacts and the other newcomers will be serviced and repaired by these outlets as efficiently as has been done in the past with other cars. Sure, the new cars may have a few wrinkles here and there that will be encountered in their servicing, but bank on the repairmen to learn these quickly and what to do about them.

Car makers, as in the past, will cooperate, making available service manuals, parts, tools, etc. The same goes for training centers, associations, jobbers and their salesmen—many others.

On this score, it's of great importance that technical education and training of members and their mechanics is among the major objectives of the Independent Garage Owners of America, Inc. In this, help will be provided through jobber and manufacturer programs, besides the courses obtainable through public schools and training centers.

There's a lot of help available to post repairmen on the new models, and these men won't be slow in catching on. They've done it with previous cars. The 1960's won't be exceptions.

Ben Ikert
EDITOR

Crankshaft journal reconditioning

The constantly increasing number of motor vehicles, more service jobs per shop and the shortage of skilled manpower are timely reminders of possibilities offered by portable, labor-saving equipment.

• IN A NEW ENGINE the crankpin journals are, of course, round and straight. If, during the full 360° revolution of the crankshaft, the bearing load remained uniform, wear of the journals would also be substantially uniform. The journals would be reduced in size, but would remain fairly round and cylindrical.

Since the bearing load in a conventional four-stroke cycle engine is applied intermittently, pressure is applied on the upper part of the crankpin when the piston is on the compression stroke. The pressure is greatly increased at the instant of ignition.

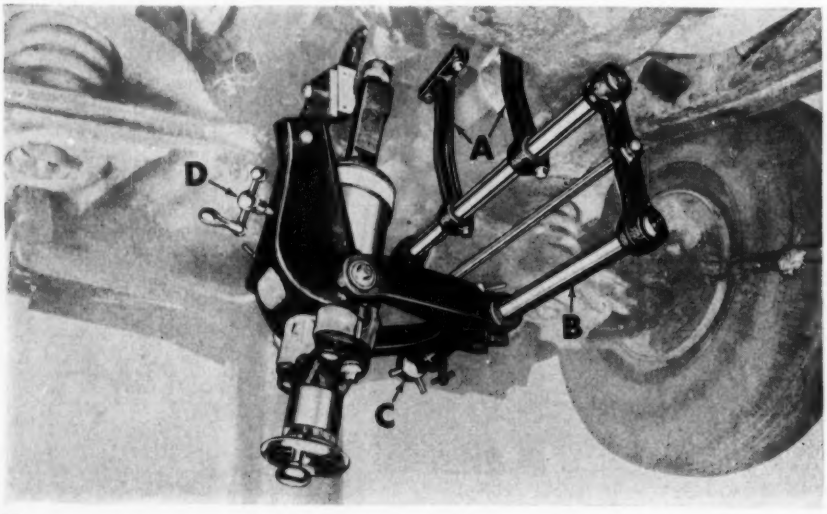
With the succeeding up stroke a great pressure is exerted on the lower portion of the crankpin journal when the piston stops at the top of the exhaust stroke. The force needed to decelerate the piston and rod assembly on the compression stroke is greater than the force due to the power stroke. Too, the same inertia forces are again applied when the piston and rod come to a stop at the bottom of the power stroke.

The net end result of all this intermittent force application is that crankpins or journals wear unevenly and eventually assume an eliptical instead of round, cross section. The journals also may be worn tapered, instead of remaining cylindrical. Mechanics who have miked journals on a worn crankshaft are, of course, familiar with this wear phenomena.

Restoring the worn journals to a round and straight condition (for installing new undersize bearings) can be done with the minimum "engine down-time" by using equipment that does the work without removing the crankshaft from the engine. This, of course, assumes that the main bearings are okeh and that there is no malfunctioning or wear conditions to warrant shaft removal.

Various portable crankpin journal reconditioning equipment is on the market, typical examples being discussed and illustrated in this article. In using this equipment an acceptable true working surface, or indexing means is obtained through locating the portable grinders on the oil pan rail, or base of

By BEN IKERT
Editor



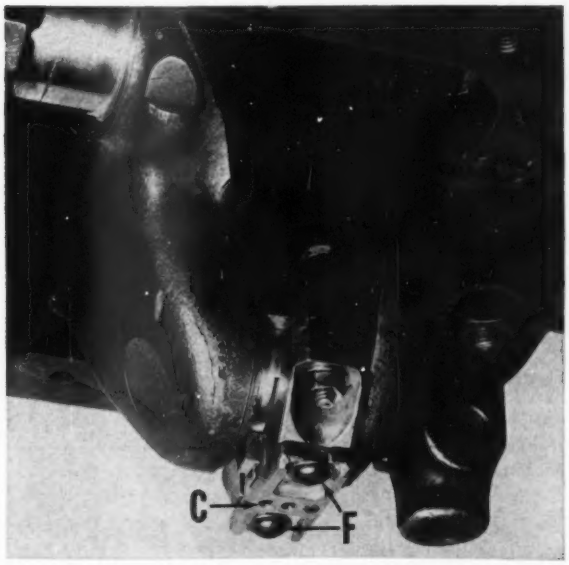
Sunnen portable crankshaft grinder shown in under-the-car use. Brackets A, are fastened to the pan rail; B, alignment bar; C, adjustment screw for centering grinding wheel on journal; D, cross feed screw. Micrometer feed hand wheel is at extreme bottom of tool.

the block. The portion of the pan rail to which the grinder brackets are bolted must be scraped clean and burrs removed with a file.

HEAD OR ROD REMOVAL UNNECESSARY

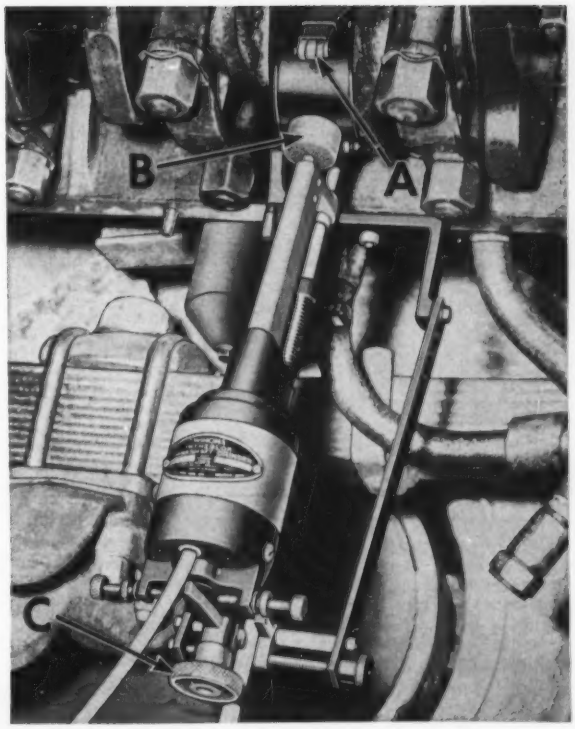
A recently introduced crankshaft journal reconditioning tool, the use of which, incidentally, does not require removal of the cylinder heads or piston and rod assemblies, makes use of the cylinder bore as a locating means from which cutting and polishing operations are guided. In this case the cap of the rod is replaced by the tool and the latter is, therefore, directly guided in its operation by the piston and rod assembly working in the bore. The maker of this tool points out that the relationship of the cylinder bores with the crankshaft axis is too critical to permit excessive variation. Hence, the logic of using the bore-piston-rod combination as the tool guide.

Reconditioning the crankpin journals without shaft removal and in an engine with main journals in good condition is well within the limits of close tolerances. It is a common practice with engines in good condition with the exception of having one or two crankpin journals which have been damaged by burned out rods. Obviously, where all crankpin journals are excessively worn, the chances are main bearings, too, are worn to the point of requiring major service work on the shaft and bearing assembly.



Tru-It crankshaft cutting and polishing tool guided by piston and rod assembly in cylinder. Three set screws, C, provide adjustment for taper correction; F, screws securing cross bar, with cutter, to side members of tool.

Journal re-conditioning without shaft removal has been done, of course, for some years, and the procedure is well known to most experienced



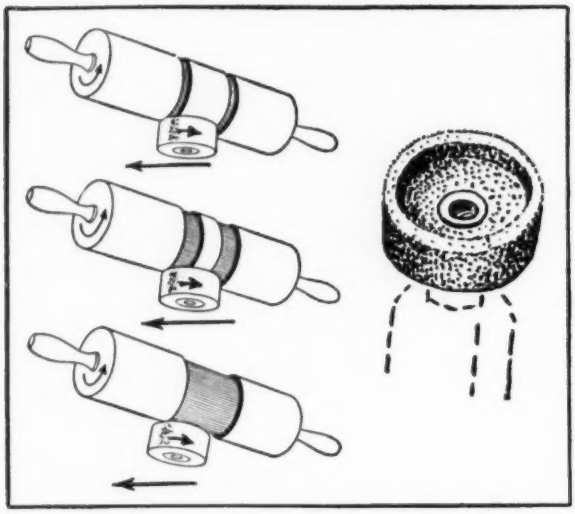
Wi-To-Co portable crankshaft grinder which handles journals from 1" to 3½" diameter in the block. Shown at A is the tail piece roller of the hook; B, grinding wheel; C, adjusting wheel for feeding stone up to journal.

mechanics. However, with more and more motor vehicles in operation, along with the acute shortage of mechanics, this article may be timely as a refresher for shop operators. The equipment involved allows fast service—mighty important to all shops, especially those which may be located in rural areas where shops often must "fix up a customer right now."

This equipment, too, is rather universal in that it can be used with available adaptations for reconditioning crankshafts in a lathe. Various ways of turning the shaft during under-car operation also are available whereby the shaft is driven by belt from motor-driven apparatus mounted above the engine, by rear wheel drive, flywheel drive and others. These drives apply for example, to Sunnen and Wi-To-Co equipment and are well-known in the trade.

In the case of the Tru-It tool, turning of the shaft is accomplished by the engine cranking motor, the spark plugs and oil pan having previously been removed. Plug removal, of course, relieves compression.

Makers of rod journal re-truing equipment furnish comprehensive instructions for its use. However, the following information will be found helpful in understanding the actual re-conditioning operations, once the equipment set-up has been made as given in the makers' instructions.



Operation of Sunnen grinder. Top-view, left: wheel cuts at opposite points. Center view: journal partially ground. Lower view: completed cut. Right: thin cup-rim grinding wheel.

Before using the Sunnen grinder the inside of the crankcase next to the crankpin journal being ground should be lined with paper shields to protect it from the cuttings. The oil hole in the shaft should be stuffed with a piece of rag. Also, the rods should be removed from the adjacent journals, and tape wrapped over the oil holes. If the cylinder head has not been removed, the spark plugs must be removed to relieve compression.

Select a wheel the width of the rod journal, less the fillets. Select the proper size shaft follower hook and fasten it to the grinder. Adjust the hook so the diameter size of the journal is set opposite the "zero" mark on the frame.

START WITH WORST JOURNAL

Grind the worst journal on the shaft first in order to get a size standard for the others. Center the wheel on the journal. With both grinder and shaft at rest, slowly run the wheel up, spinning it with your fingers until a light contact is made with the shaft. If necessary, shift the grinder by means of the centering adjustment on the alignment bar, to allow free entry of the wheel between the cheeks of the journal. After contact has been made back up the micrometer feed slightly to free the wheel.

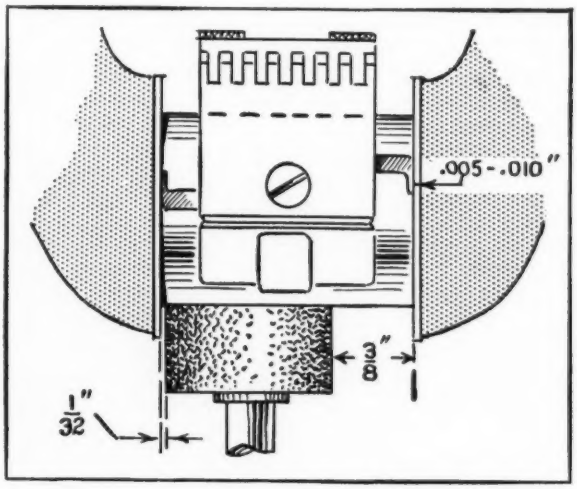
Start the grinder motor. See that the spindle and grinding wheel are under the center of the journal. If sparks are made on either journal cheek, shift the grinder slightly.

Turn on the crankshaft drive. Feed the grinding wheel away from the hook across the journal by means of the cross feed screw. If no contact is made bring the wheel back to center and slowly turn the micrometer feed up until a cutting contact is made. Again feed the wheel outward slowly as the shaft revolves. Usually it will start cutting at the ends of the journal. Repeat the operation several times until cutting also takes place at the middle of the journal.

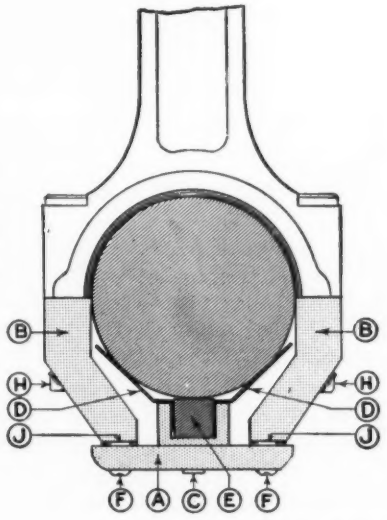
The journal probably is not yet rounded up, but does provide a straight surface on opposite sides for measuring taper. Measure diameters at both ends of the journal, and if taper is present make correction.

Now feed the wheel slowly back and forth across the journal, feeding it up .001" at the end of each pass. (Depth cuts are alternated, first from center out and then from the outward position in.)

Proceed with the grinding until shaft is about cleaned up, then measure for size. Before backing the wheel away from the work, loosen the knurled set screw on micrometer feed-up wheel and turn micrometer collar to read zero. Then if another cut is necessary, "zero" will be the point at which the grinding wheel contacts the work, giving a con-



Hook is centered on journal when using Wi-To-Co grinder. Clearance from stone to flange is 1/32" and stone travel should be at least 3/8". The hook guide clearance allowance is from .005" to .010".



Details of Tru-It tool. A, cross bar; B, side members; C, taper adjustment screws (3); D, springs; E, cutting tool; F, button-head screws; H, thin wall nuts; J, shims.

venient reference point for removing balance of stock.

When the rod journal is within .002" of size, finish out by taking light cuts and checking. As a rule .001" feed on the micrometer hand wheel will reduce the rod journal .001" on the diameter. This is not always true, due to wheel wear or the way the operator feeds the wheel across the work.

A special micrometer (furnished with the grinder) lets the operator measure the shaft without removing the grinder from the work. Its use keeps a positive check on the work being ground.

POLISH TO A FINE FINISH

The journals should be polished to a fine finish after they have been ground substantially to size. The maker states that the finishing operation should cause no appreciable removal of stock—usually a half thousandth (.0005") should be allowed for finishing the journals by polishing.

The polishing can be done by lapping each journal with a fine grain abrasive cloth (150 to 240 grit). An easy way to do this is to first cut a strip of abrasive cloth the width of the journal and about 8" in length. The journal is coated with plenty of oil and the abrasive strip wrapped tightly around the journal. A 4' length of leather lace is then wrapped around the journal, allowing it to make one loop, leaving two ends to pull by hand.

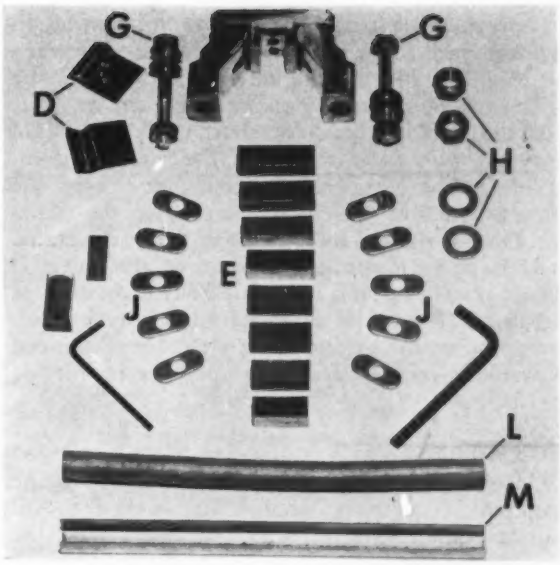
Holding each end of the lace, the mechanic slowly starts pulling the lace in and out in a sort of see-saw motion. The loop thus progresses back and forth across the journal and applies pressure to all parts of the abrasive cloth against the journal surface. The polishing should be done for about one-half a minute with the crankshaft revolving.

REMOVE PLUGS AND PAN

The procedure to be used with the Tru-It tool requires, first of all, removal of the spark plugs from all cylinders and also the engine oil pan. Next, remove the cap from the connecting rod on the worn crankpin, allowing the rod upper bearing insert to remain in position for grinding the tool. Remove excess babbit before installing the tool.

In order to compensate for shaft journal diameter greater than 2" the maker supplies a set of eight, 1/16" shims. For journals 2" to 2.062" dia., one shim is used on each side of the tool under the cross bar; 2.0625" to 2.120" dia., two shims; 2.125" to 2.200" dia., three shims; 2.250" to 2.375" dia., four shims. No shims are needed for journals less than 2" diameter.

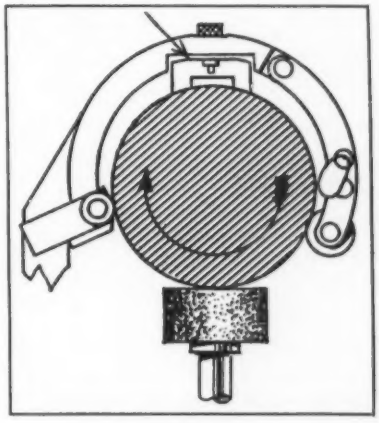
Compare the diameter of the journal to be reconditioned with the diameters given and, if necessary, use shims as required. Then select the correct length of cutter according to the width of the crankpin. It is highly important that the end of the cutter marked with an arrow be placed on the tool so the arrow points to the front of the engine and



Parts of Tru-It tool. Springs are shown at D; E, cutters; G, special bolts for offset rods; H, thin wall nuts and washers; J, shims; L, rubber for abrasive material; M, channel to support L.

corresponds with the direction of crankshaft rotation.

Loosen the three set screws located crosswise in the tool cross bar to allow the springs and cutter to bottom in the tool body. Loosely assemble the parts by lightly tightening the two button-head screws. Check the diameter of the worn crankpin with a micrometer to obtain the extent of taper or flat. Be sure to plug the oil holes of the shaft to keep out cuttings.



Purpose of the size block on the Wi-To-Co grinder is to center the grinding wheel on the journal which lines up the pivot shoe (arrow) in the hook.

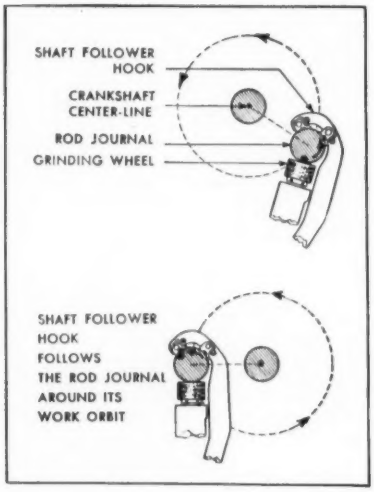
Attach the assembled tool in place of the removed rod cap using the two washers and 3/8" thin wall nuts. Then loosen the two button-head screws and center the cross bar between the two side members and retighten. Make sure that the top inside surface of the side members contacts the journal to hold the top bearing insert in position.

Revolve the engine by hand for one revolution to make sure there is adequate clearance between the tool and adjacent engine parts. After that the engine can be rotated by the cranking motor.

If the micrometer check shows a flat crankpin leave the two outer screws of the three-screw assembly in the cross bar retracted, but tighten the center screw until the cutter just contacts the crankpin. Do not tighten the set screws when the crankshaft is at its lowermost position as the cutter is almost certain to bind upon subsequent rotation of the shaft. If the tool indicates ample block clearance, revolve the engine about eight times by hand or cranking motor, depending upon the severity of the flat spot.

CHECK WITH MICROMETER

Once the tool has been correctly adjusted for the crankpin in question, remove the assembled tool (for micrometer checking) by loosening ONLY the nuts on the two bolts which secure the sides of the tool to the connecting rod. Then make a micrometer check to see if further grinding is necessary. If it is necessary, replace the assembled tool to the rod and retighten only the center of the three set crews,


SHAFT FOLLOWER HOOK
CRANKSHAFT CENTER-LINE
ROD JOURNAL
GRINDING WHEEL
SHAFT FOLLOWER HOOK FOLLOWS THE ROD JOURNAL AROUND ITS WORK ORBIT

In the Sunnen grinder the rod journal revolves in a shaft follower hook and the grinding wheel is applied to the open end of this V-shaped rest.

already mentioned, to increase pressure of the cutting tool on the journal. The latter can be ground to any desired diameter.

Here's what to do with a taper-worn journal. Determine the amount of taper and the journal requiring the most grinding. Revolve engine about eight times, by hand or with the cranking motor. Then, remove the tool by taking off the nuts on the two rod bolts and mike the journal. Once the taper is removed and the tool is reinstalled, retract both outer set screws and tighten only the center set screw until the cutter just contacts the journal. Then grind the journal to a round and true diameter.

It is not necessary to grind the journal to a standard diameter as bearing inserts can be resized to any reasonable specified diameter by parts distributors.

To polish the journal a piece of abrasive material (emery cloth, etc.) is wrapped around the rubber material supplied in the tool kit, press fitted into a length of channel cut to match the width of the journal. The tool cutter is removed and replaced with the polisher and the tool reinstalled on the rod. By revolving the engine several revolutions with the cranking motor, the retrued journal can be polished to mirror smoothness.

With the Wi-To-Co grinder, turn the crankshaft over by hand several times to see that everything clears, and if no obstructions are present you are now set to start your grinding operations. Plug the drive unit plug into the outlet near the grinder switch so that when you turn the grinder on, the drive will go on also; but be sure you have a firm hold on the grinder as the torque is fairly strong.

At this time the amount of taper present in the journal when it was measured is recalled, so turn the grinder on and feed the stone slowly up to the journal until it starts to throw sparks. By traversing the grinder slowly from one side to the other, the wheel should throw sparks uniformly from one side to the other. If it does not, adjust the taper control handwheel so it does. Knowing how much taper was in the journal before you started grinding, you can now turn the taper adjusting handwheel the right amount to compensate for the taper.

MUST ADJUST FOR TAPER

In other words, had you adjusted the stone to throw sparks evenly from side to side and had you left the taper adjustment alone you would finish the journal with approximately the same taper as when you began. By making an adjustment for taper you correct it immediately so that on the first check for size there will be little or no taper.

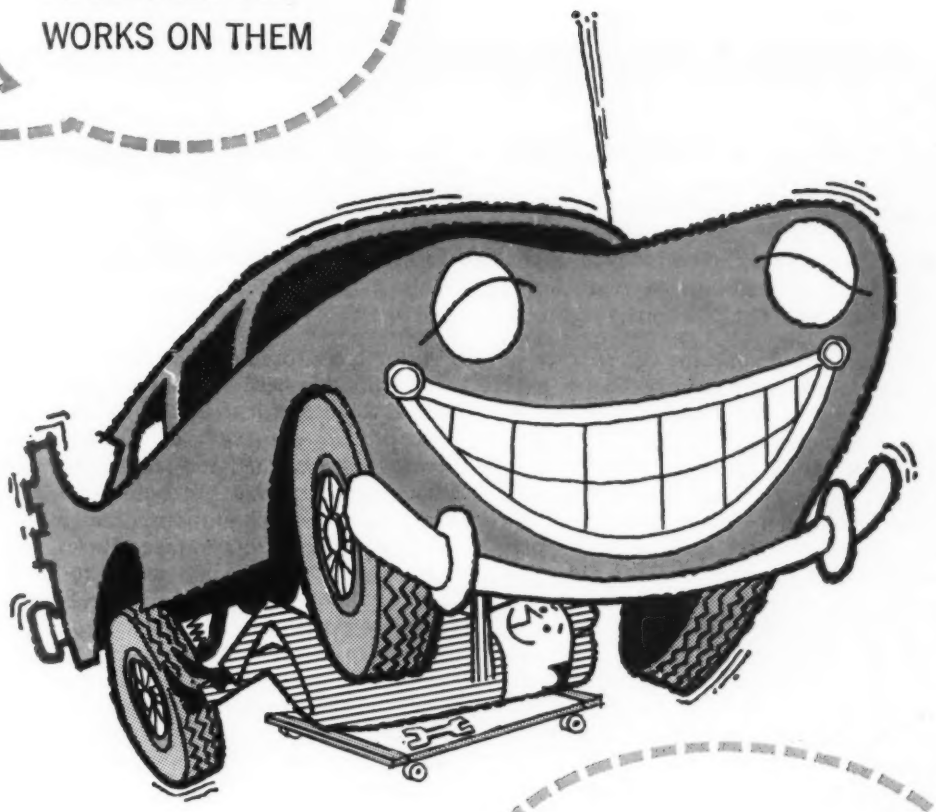
By turning the taper control handwheel one full turn you will compensate for approximately .002" taper. When adjusting the taper control handwheel it is sometimes difficult to remember which way to turn it. A rule that could be used is this: "Turn right, go right," or "High on the right, turn right." This means that if the journal is larger on the right you must bring the bottom of the grinder over to the right. So, by turning the handwheel right (clockwise) you will move the bottom of the grinder to the right.

After using the grinder a while, the operator will get the feel of his machine so that he can tell without even thinking, when and how much he has to adjust for taper. That is the main reason for proceeding cautiously at first; to get to know the machine and its capabilities and gain confidence in it.

At first, grind only enough to clean up the journal so that you can measure and find out how the grind-

(Continued on page 64)

CARS ARE TICKLED
PINK WHEN JOE
WORKS ON THEM



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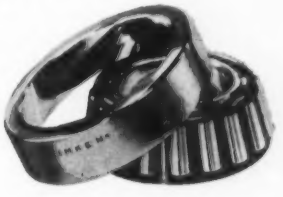

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Servicing the Austin-Healy Sprite

General knowledge of the design, observance of necessary clearances, tolerances and torquing specifications opens the door for custom or general maintenance applicable to this popular, foreign-built sports car.

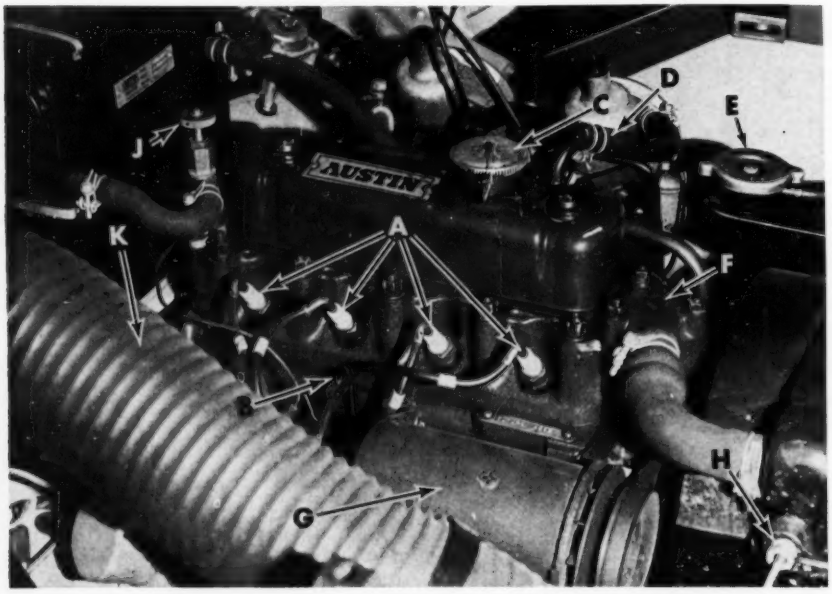
By P. K. SNOOK

• Zooming sales and rapid consumer acceptance of the recently introduced Austin-Healy Sprite have verified the soundness of the basic ideas that the designers have incorporated into this lively little import. Clean lines, sports car performance, economy of operation, and a purchase price tailored to the average man's pocketbook have made the Sprite one of the most popular of the foreign built sports cars. The need for competent service for these imports is growing. You're in the service business, so why not add the Sprite to your list.

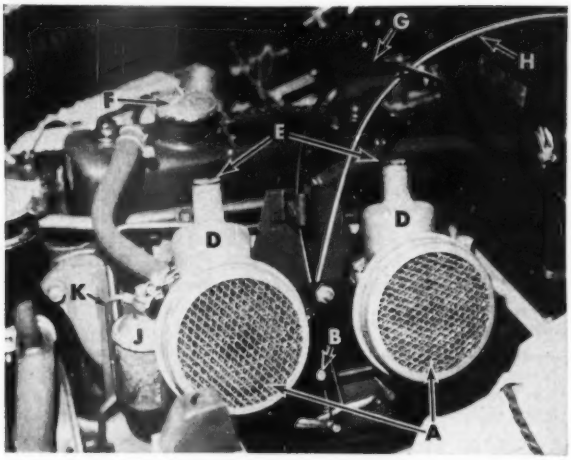
The front fenders and hood are integral and open as a single unit. To release the hood lock, turn the "T" handle on the front of the hood just below the grill clockwise. Reach under the bottom of the hood and you will be able to feel the lever of the safety latch which is mounted on the left hand frame horn. Pull the lever forward and raise the hood.

The hood is held open by two telescopic spring-loaded tubes, but it's not a bad idea to also use the solid prop as a precaution. The rod is clipped to the underside of the hood and the lower end should be set in the bracket just below the heater intake. The full envelope hood is a common sight on competition cars at European race courses, but the Sprite is the first production line import to have it.

With the hood open and a good view of the engine compartment, let's take a moment and locate the various components we'll be working on. As we face the engine, the dual S.U. carburetors, float bowls, fuel lines, air cleaners, and fuel pump are on our right and the generator, thermostat housing, coil, spark plugs, oil dip stick, distributor, and starter are on our left.



A—Spark plugs; B—Crankcase dipstick; C—Oil fill; D—Upper breather; E—Radiator fill cap; F—Thermostat housing; G—Generator; H—Water temperature bulb; J—Heater shut-off; K—Fresh air intake.



A—Air cleaners; B—Lock nut for throttle connect linkage; D—Dash pots; E—Damper fillers; F—Oil filler; G—Idle adjust cable; H—Choke cable; J—Float chamber; K—Fuel overflow.

With the exception of a few of the carburetor and fuel system fittings, all nuts, bolts, and threads are standard S.A.E. and a good set of sockets and wrenches will be all we need. Servicing the Sprite doesn't require special tools or equipment, just a bit of extra care and thoroughness.

IGNITION SERVICE

First on our service list is ignition. Like most of its small displacement import cousins, the Sprite relies on an engine with lots of rpm rather than lots of cubic inches for its power. To deliver its full 43 horses, it has to wind up to 5,200 rpm, and it just won't do it unless every link in the ignition system is functioning 100%.

Let's begin our check of the system by pulling the spark plugs. The ignition wires have snap fittings, so pull them off and remove the plugs with a standard size plug socket.

After cleaning or replacing, regap the plugs at .025", fit with new gasket washers, and torque them back in at 22 ft./lbs.

High speed miss and ignition breakup can often be cured just by servicing the plugs, **provided** new washers are fitted and the plugs are properly torqued in.

Since thorough servicing obviously includes more than a new set of plugs, we'll move on to the next link in the Sprite ignition system, the Lucas DM-2 distributor.

Remove the cap and rotor and make sure all contacts are clean and free of corosion. Contact breaker point service is conventional and the gap should be set at .015". Add a drop of light oil to the contact hold down screws and a few drops to the screw inside the hollow cam spindle. A touch of cam lubricant on the cam itself will help reduce wear of the fiber follower arm. Check the vacuum advance for free movement and add a drop of oil to the pin that holds the advance arm to the distributor plate. Give the contact pivot pin a drop of oil and the distributor can be checked off as serviced.

IGNITION TIMING

The factory recommends a timing setting of 5° advance for normal driving, using a premium grade fuel. The firing order is 1,3,4,2, with number 1 cylinder nearest the radiator, and the timing mark on crankshaft damper. The timing arrow is on the engine just above the generator. A micrometer-type adjustment is incorporated into the distributor and can be used for making minor adjustments. Actually, this adjustment is nothing more than a knurled nut threaded onto the end of the vacuum advance shaft and limiting the degree of return when the advance is not in action.

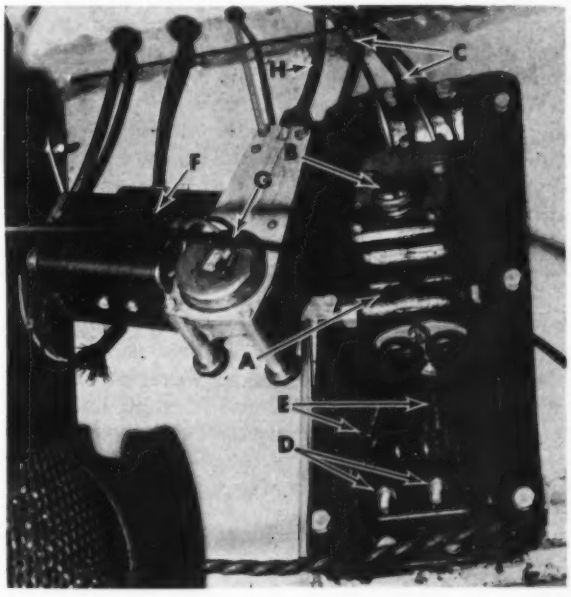
One click on the micrometer is equal to ½° of advance or retard and there is a small arrow on the distributor body just above the nut to indicate the direction it should be turned for the desired correction.

The valves are operated by a conventional push-rod and rocker arm system and clearance should be set at .012" with the engine hot. To remove the valve cover, unscrew the two knurled plastic thumb nuts and lift straight up, taking care not to tear the cork gasket.

CARBURETION

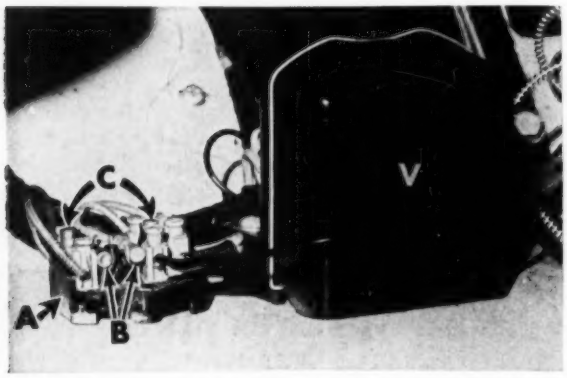
Few American mechanics have ever heard of oiling the carburetor, but it's a standard procedure, and one that should never be overlooked, when servicing any car fitted with S.U. carburetors. (For complete details on the S.U. carburetor, refer to page 28 of the December, 1959, issue of ASD.)

A—Clutch-Brake master cylinder; B—Filler cap; C—Hydraulic lines; D—Adjusting linkage & nuts; E—Return springs; F—Wiper motor; G—Gear housing; H—Wiper drive cable.



If the Sprite you're servicing dies at a slow idle or uses an excessive amount of gas without delivering the power it should, one, or both of the carburetor pistons may be sticking in the dashpot.

To check for a sticky piston, remove the air cleaners and lift the piston as far as it will go. A pencil, icepick, or small screwdriver will work well for this. When the piston is released, it should drop fast enough to strike the carburetor bridge (at the bottom of the venturi) with an audible click. If either piston shows signs of sticking, remove the three screws that hold the dashpot to the carburetor body and lift the dashpot, piston, and needle out. Slide the piston out and wash the whole assembly in lacquer thinner to remove any residual buildup on the inner dashpot wall or piston flange. Before reassembling, smear the piston flange with light oil.



A—Fuse block; B—Active fuses; C—Spare fuses; V—Volt-reg.

If the pistons are free, and the engine still dies at idle or low speeds and there's good pressure at the fuel line junctions, check the fuel float chambers. A sticking needle valve could be the cause, particularly if the car has been stored, since gum in the fuel will occasionally polymerize and cause these small valves to hang up.

Although additional adjustments to the carburetors should only be made after all other engine tuning (ignition, valve adjustment, etc.) has been completed, we'll cover it here with the rest of the information on carburetors.

ADJUSTMENT PROCEDURE

Before making any adjustments on the carburetors, warm the engine up to its normal operating temperature and remove the air cleaners. Loosen one of the spring couplings on the throttle shaft between the two carburetors, and back off both carburetor idle screws until the carburetors are completely closed. Turn the rear carburetor idle screw down until it's just touching the flange it seats against, then give it exactly one more complete turn. This will set the rear carburetor for a fast idle, and put the front one out of action (as an additional measure, the piston on the front carburetor should be blocked up about 1/2").

GENERAL SPECIFICATIONS

Engine	4 cyl. O.H.	Length	11'-3⅜"
Bore & Stroke	2.48" x 3.00"	Width	4'-5"
Displacement	57.87 cu.in.	Height	4' 1¾"
Brake Hp.	43 @ 5,200 rpm	Castor angle	3°
Compression ratio	8.3:1	Camber angle	1°
Firing order	1-3-4-2		
Valve clearance (hot)	.012"	**CAPACITIES**	
Spark plug gap	.025"	Fuel tank	7½ gal. (U.S.)
Breaker point gap	.015"	Crankcase (incl. filter)	7 pt. (Imp.)
Tire size	5.20 x 13	Cooling system	10 pt. (Imp)
Pressure (front)	18 psi	Transmission	2-1/3 pt. (Imp.)
Pressure (rear)	20 psi	Differential	1-¾ pt. (Imp.)
Wheelbase	6'-8"		

Start the engine and adjust the mixture screw on the rear carburetor for the best setting at this speed. While making the adjustment, make sure that the jet head is kept against the adjusting nut. The setting may now be checked by lifting the piston 1/32" with a small screwdriver. If the setting is correct, the engine will pick up speed slightly for a moment and continue to run smoothly. If it dies, the mixture is too weak. If any appreciable increase in speed results, and continues even when the piston is raised an additional 1/4", it indicates that the mixture is too rich. When you have the rear carburetor set correctly, block up the piston on the rear carburetor and repeat the tuning procedure on the front carburetor.

Assuming that both carburetors are now correctly set for mixture, we must now adjust the idle and synchronize them. Back off each idle screw until it just touches its seat and then give it one full turn the other way. The engine will now idle a bit fast and the screws can be alternately backed off a fraction of a turn at a time until the idle speed drops to 500 rpm.

Synchronization can be checked by listening at each venturi, and adjusting until the hiss is of equal intensity at both carburetors. The carburetor with the louder hiss is open the farthest and adjustments should be made accordingly. When both are the same, tighten the throttle linkage and recheck the jet adjustment with the piston lifting routine.

The air cleaners are dry element type and should be cleaned by washing in gasoline and blowing out with an air jet. Dip the clean filters in engine oil, drain, and refit to the carburetors.

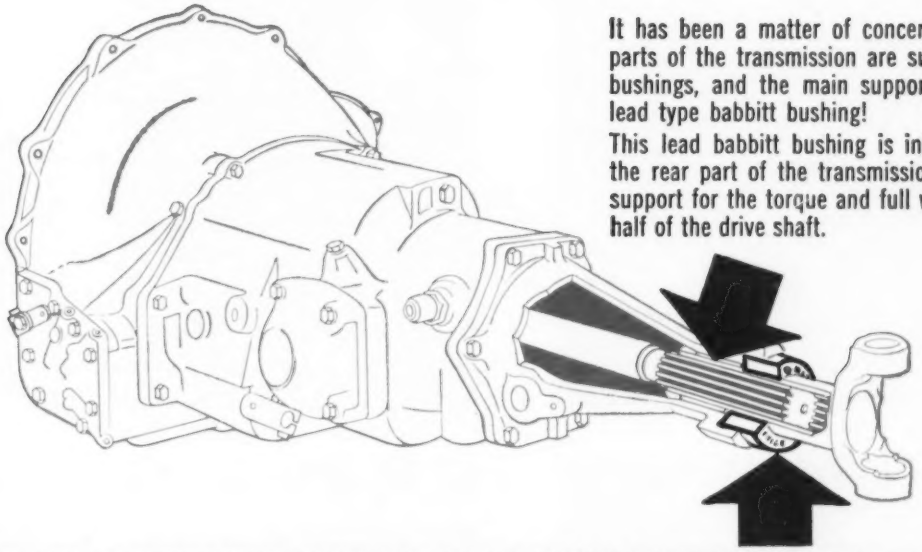
IMPORTANT LUBE POINTS

Lubricating a Sprite properly includes getting at some out-of-the-way fittings that you don't have on American models, but don't neglect them; they're important. Among these are grease fittings at the center of the flexible section of the hand brake linkage, and on both universal joints. The front "U" joint fitting is accessible by rolling back the mat on the

(Continued on page 30)

Mr. Mechanic - Mr. Jobber

The SEAL-O-MATIC will save you hours of labor and give thousands of miles of perfect performance!

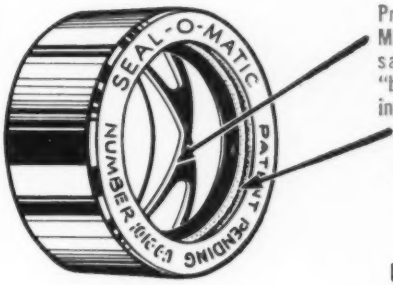


It has been a matter of concern that all moving parts of the transmission are supported solely by bushings, and the main supporting bushing is a lead type babbitt bushing!

This lead babbitt bushing is intended to support the rear part of the transmission and is the only support for the torque and full weight of the front half of the drive shaft.

THE ONLY POSITIVE WAY TO GIVE COMPLETE SUPPORT AT THIS POINT IS TO INSTALL THE BPS SEAL-O-MATIC.

To replace the original babbitt bushing it is necessary to completely remove the transmission, drive the old bushing out and drive the new bushing in. Not only is this a costly labor job, it is not even a sure cure — because the new bushing is still a lead babbitt bushing and will fail again. When the original lead babbitt bushing gets slightly worn or is not reamed perfectly, it lets the drive shaft whip ever so slightly, and you experience a snapping or clunking sound when the transmission changes gears. This whip leads to eventual failure of the rear transmission oil seal. The problem is found in new cars as well as older models.



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Oil Seal - Neoprene Self-Aligning
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List Price $11.95

SEAL-O-MATIC INSTALLATION INSTRUCTIONS

It is not necessary to remove the transmission or the original babbitt bushing to install the SEAL-O-MATIC bearing seal. Just remove the 2 U-bolts from the rear universal joint, drop the drive shaft down and slide the entire drive shaft assembly out of the transmission; knock out the rear oil seal which protrudes from rear of transmission; and replace this original seal with the SEAL-O-MATIC. Replace drive shaft and reconnect rear universal joint. Approximate time for the entire replacement operation — 15 minutes! The SEAL-O-MATIC with its built-in bronze precision bearing will hold the shaft in perfect alignment, and its built-in oil seal will prevent transmission fluid leakage.

See Your Distributor or Write the Factory for Full Information

BPS

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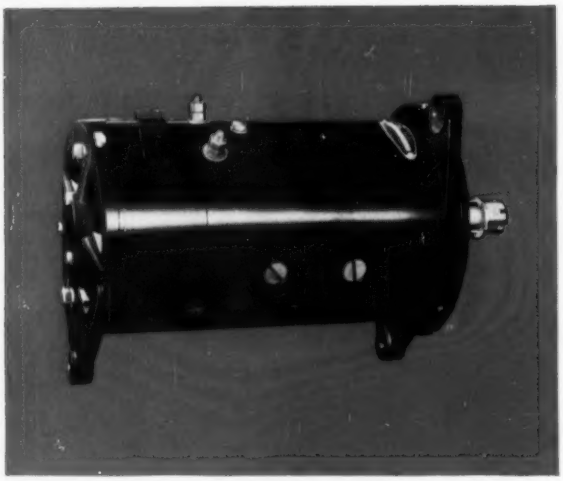
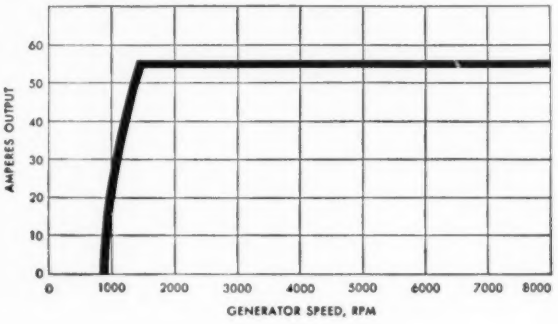
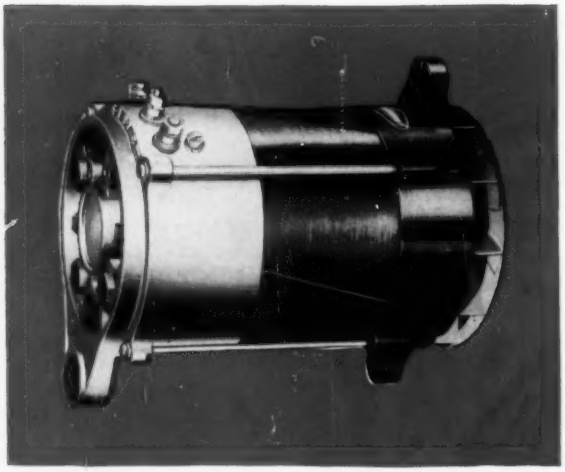
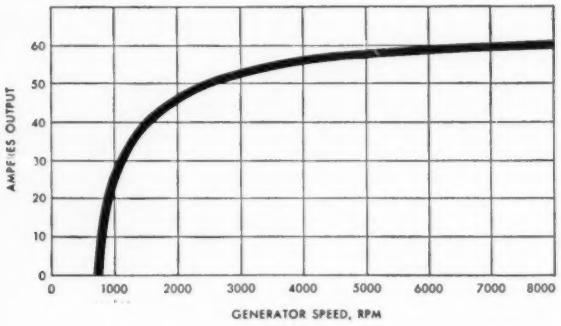


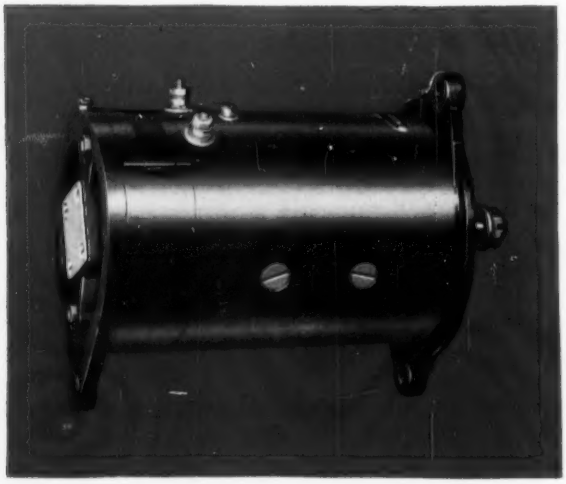
1106991 EXTRA-OUTPUT D.C. GENERATOR—12 volts • 55 amperes • 12 amperes at idle—For cross-country trucks, school buses and other vehicles with extra electrical equipment.





1117070 SELF-RECTIFYING A.C. GENERATOR—12 volts • 60 amperes • 27 amperes at idle—For high-duty vehicles with heavy electrical loads . . . operating at all speed ranges. Ideal for excessive low-speed operation and curb-idling.





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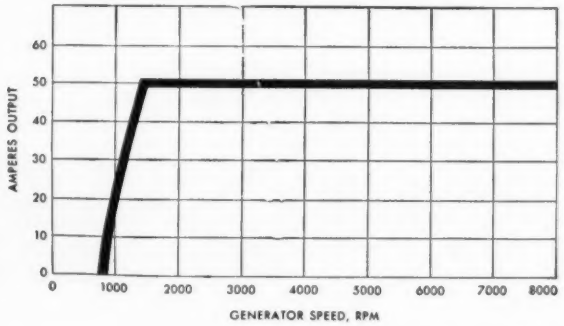
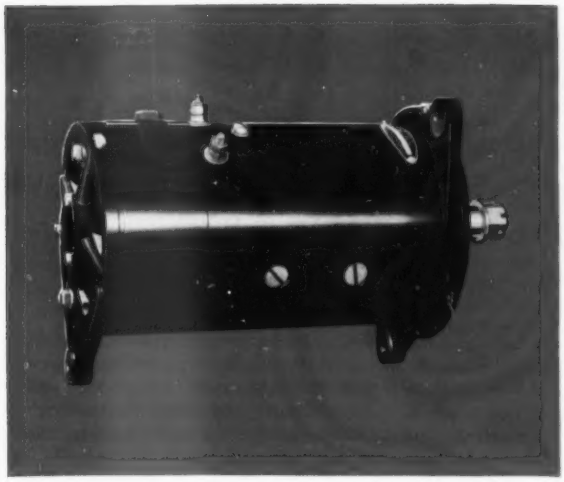
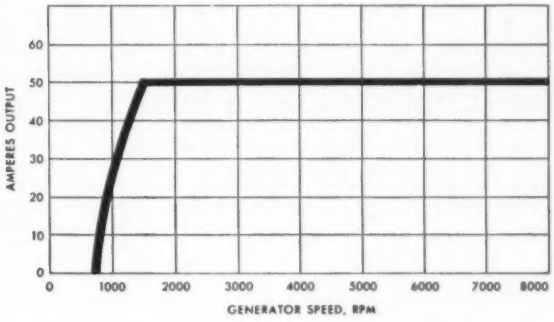
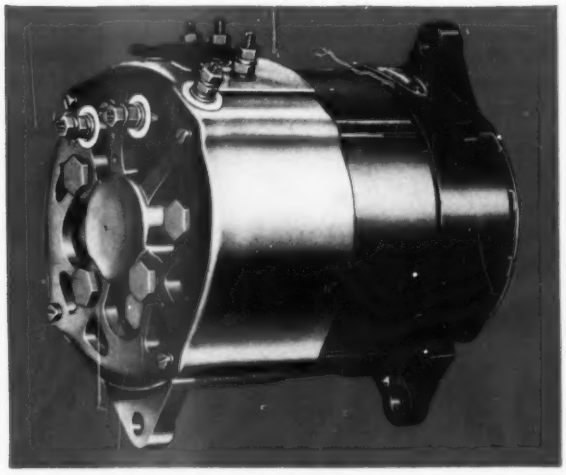


TO JOB CONDITIONS



1106986 EXTRA-OUTPUT D.C. GENERATOR—12 volts • 50 amperes • 20 amperes at idle—For metropolitan trucks and school buses, with extra electrical equipment . . . operating at low speeds and with engine idling most of the time.





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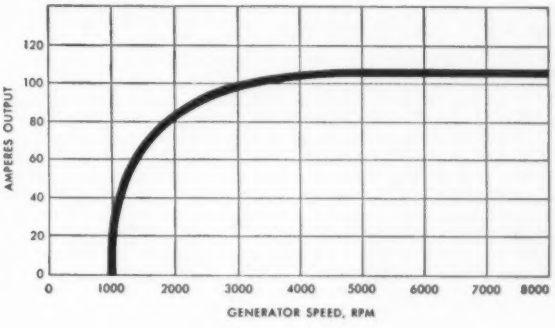

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Ignition ballast resistors

Purpose of this unit in the ignition system is to provide full design-voltage at the ignition coil for easy, cold-engine starts. How unit operates and how it is checked with a volt-amp tester are discussed.

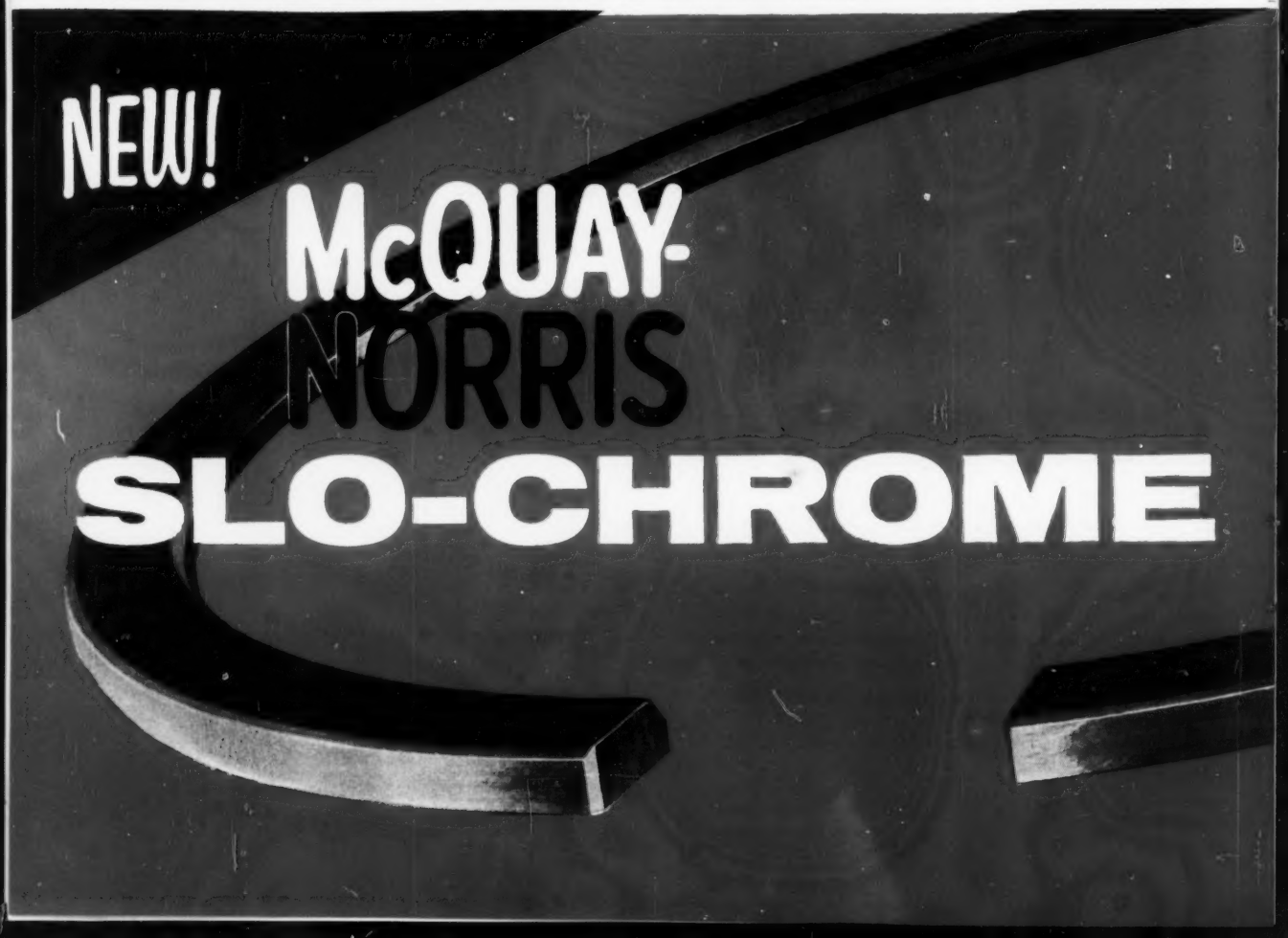
By GUY F. WETZEL Technical Editor

● MOST 12-VOLT ignition systems incorporate a unit whose purpose and function is not too well understood—the ballast resistor.

The most important reason for having the resistor in the ignition circuit is to have full design-voltage at the ignition coil for starting the engine. When the heavy current draw required by the cranking motor is supplied by the battery, there is a normal voltage drop of two to three volts from the 12-volt battery EMF during the time the cranking motor is operating. With the identical circuit used on 6-volt systems (no ballast resistor) and just when a good spark is needed for starting, this voltage drop means a reduced voltage current flow is supplied to the ignition coil.

To offset this condition, the 12-volt ignition coil is designed to operate on approximately 9 volts, with the ballast resistor inserted in the ignition circuit. The resistor has sufficient resistance to cause a voltage drop of around 3 volts with the idle speed ignition current of approximately 2 amps. According to Ohm's Law, this requires a resistance of approximately one and one half (1.5) ohms.

The manner in which full battery voltage of 9 to 10 volts is delivered to the coil while the cranking motor is operating is by temporarily by-passing the ballast resistor. This is done by run-



ning a conductor either directly or indirectly from the dead side of the cranking motor starting relay to the battery side of the coil. With the cranking motor operating, the intended battery voltage is only 9 to 10 volts, so that the coil will provide a hot spark for starting.

The resistor by-pass circuit is used on Ford and GM cars, but on Chrysler-built cars the same effect is obtained in another way. On these cars the resistor offers a resistance which varies with temperature. When the resistor is cold it has a very low resistance so that there is little voltage drop. Then, as the resistor warms up with the current flowing through it, the resistance increases to approximately 1½ ohms, reducing the battery voltage in the ignition circuit to approximately 9 volts before the generator cuts in.

The plan of using either the temporarily by-passed resistor or the variable resistance resistor, materially helps in engine starting, especially cold starts. This is one of the two important benefits gained by changing from 6 to 12 volts. The other is improved spinning power of the 12-volt starter.

In addition to easier starting, there is a definite improvement in high speed engine operation. With the former 6 volts, the required ignition high tension voltage was getting dangerously close to the available voltage. Thus, with some added resistance in the high-tension circuit (spark plug gap enlarged by electrical erosion and a rounded end on the insulated center plug electrode) many of the 6-volt engines were "running out of ignition" at high speeds and/or heavy engine loads.

The main reason for running out of ignition with higher speeds is that the action of the breaker points interrupting the primary current flow from the

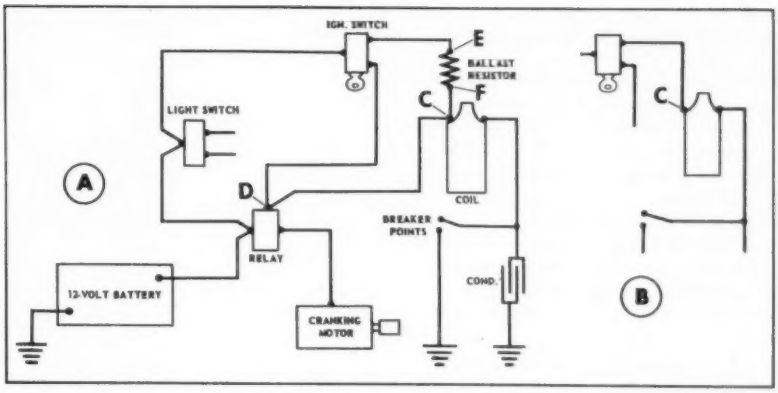


Diagram showing at A a 12-volt ignition system with ballast resistor. Diagram B shows absence of resistor between ignition switch and coil in a 6-volt system. To check voltage drop in diagram A while the cranking motor operates, connect a voltmeter from C to ground. Conductor C to D is the by-pass circuit cutting out the ballast resistor when the cranking motor is energized. To note changes in the resistance of the ballast resistor, connect voltmeter to E and F. Under same conditions, to check voltage drop in diagram B, connect the voltmeter from C to ground. An ammeter in series with the circuits A and B will indicate changes in current with engine speed.

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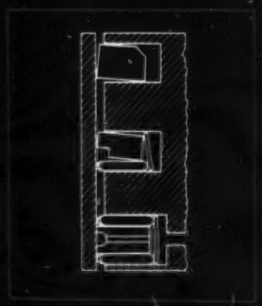


THEY STAND OUT BECAUSE THEY STAND UP!

McQUAY-NORRIS

CHROME CONTROL

LEAK-PROOF®

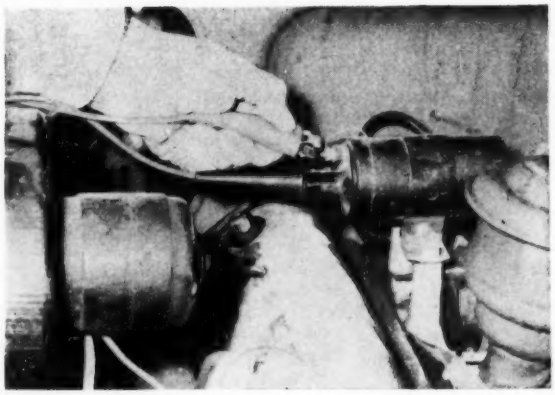
PISTON RINGS

Ignition Ballast Resistor . . . CONTINUED

coil reduces the original ignition current of approximately 2 amps to as little as 7 or 8 tenth (0.7-0.8) amps. This materially reduces the watts of energy available for ignition. With higher secondary voltage required due to larger air-fuel charges in the cylinders and resultant higher compression pressures surrounding the spark plug gaps, it is apparent that a limit of engine performance was substantially reached.

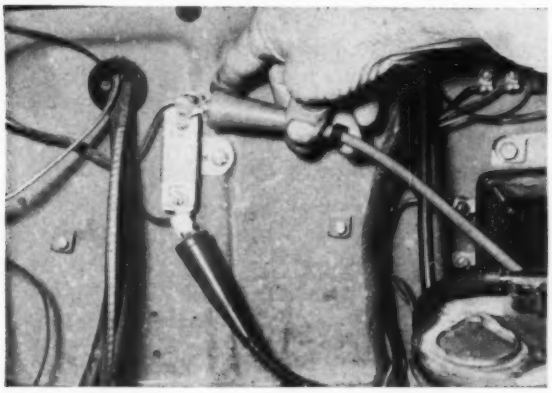
With 12 volts and a ballast resistor in the ignition circuit there is a beneficial action to help supply additional voltage for partially offsetting the amperage lost because of point damping action at higher speeds.

At idle speed and low-load road speed, ignition current is about 2 amps (previously mentioned). It should be recalled that the voltage drop through a resistor is proportional to the amperes flowing through it; more amperes, more voltage drop within the current-carrying capacity of the resistor. The normal voltage drop across the ballast resistor is, as we have seen, about 3 volts. Now if the current through the resistor is reduced to 1 amp, the voltage drop will also be reduced; in this case to about 1½ (1.5) volts. This will make the ignition system voltage go up accordingly, so that with the generator supplying the current the voltage will be around 14.6, minus 1.5, or 13.1 volts.



Connect the voltmeter to the battery side of the coil to check voltage in the ignition circuit under different operating conditions.

Watts of electrical energy in a DC system is the product of volts times amperes. The watts of energy at low engine speeds in a 12-volt system with a ballast resistor is 9 (volts) times 2 (amps), or 18 watts. At high speeds, with voltage drop through the ballast resistor reduced, and with the ignition current reduced as previously mentioned, there would still exist 13.1 volts times 1 amp (approx.) or 13.1 watts. To compare this with a 6-volt system without a ballast resistor, there would be, at low speed, 6 volts times 2 amps, or 12 watts, and at high speed around 7.4 volts (generator voltage) times 1 amp or 7.4 watts. All the values given here are the watts of energy available for ignition. Thus at high speed with a 12-volt system, more energy is available for ignition than at low speed with the 6-volt system.



Connect the voltmeter across the ballast resistor to observe the changes in voltage drop as the current in amperes is reduced by the damping effect of the breaker points.

Based on these figures, the drop in watts from low speed to high speed is 38% with the 6-volt system and only 33% with the 12-volt system. By the use of the ballast resistor, in addition to the gain in starting by by-passing the resistor, approximately 1½ volts are gained at high speed through the action of the resistor. This increase in voltage steps up the available high tension voltage sufficiently to minimize the liklihood of running out of ignition. The increase in voltage at high speeds cannot cause damage because amperes, not volts, cause coils to burn out or points to burn. In the ignition system the current is definitely limited by the damping action of the points so it can never get any greater than the initial current passing through the points.

This can be proved by connecting a voltmeter from the battery side of the coil to ground and inserting an ammeter in the ignition circuit. With the ignition turned on and points closed, note the voltmeter and ammeter readings before starting the engine. Then with the distributor side of the coil grounded, or the wire from the high tension tower of the distributor pulled out, so the engine will not start, turn the engine with the starter. Read the voltmeter, which should not vary more than 1 volt from the first voltage. It will be actual battery voltage, but the battery voltage will be reduced because of the cranking motor load. This may vary somewhat due to the state of charge of the battery. At this time the ballast resistor is by-passed.

Now, remove the coil grounding wire or put back the high tension distributor lead and start the engine. Run it at idle speed and note the voltage and current. Speed up the engine gradually, watching the meters. Current will decrease and voltage will increase.

To see the effect of the ballast resistor directly, connect the voltmeter across the resistor, observing meter polarity. Increase engine speed gradually to 3500-4000 rpm. The voltage drop changes from around 3 volts to a little over 1 volt, the exact figures depending on the particular model on which the test is made.

From this analysis a better understanding should exist of the changes in voltage and current that take place in the ignition circuit.

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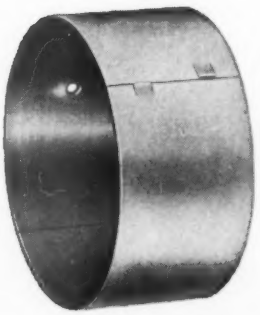


CUSTOM-CRUSH is just one of the many features that make McQuay-Norris Bearings stand out. Longer engine life, less down time are assured. CUSTOM-CRUSH means perfect saddle fit, complete heat transfer.

* THE SPECIAL McQUAY-NORRIS CRUSH ALLOWANCE AT THE SPLIT LINES ASSURES PERFECT SADDLE FIT.

ORIGINAL PRODUCTION BEARINGS HAVE A UNIFORM AMOUNT OF CRUSH BECAUSE ALL PARTS ARE NEW. REPLACEMENT BEARINGS SHOULD HAVE A SPECIAL CRUSH AT THE SPLIT LINES TO COMPENSATE FOR SADDLE WEAR AND DISTORTION.

NEW! McQUAY NORRIS "Alum-lined" engine bearings are available for late model engine applications.

MORE THAN 6400 NUMBERS of all types—a bearing for every need.

Austin-Healy's Sprite . . *(Continued from page 22)*

transmission tunnel and removing the round rubber plug on the right side just behind the hand brake.

The spring, screw, and felt pad on the rear generator bearing housing should be removed and the tube about half filled with light grease.

The water pump bearing can be lubricated by removing the small screw on the right side of the pump body, just behind the generator. Use S.A.E. 140 oil. On the "oil can" list are brakes, clutch, and carburetor linkages, and door and hood latches and hinges.

The transmission should never be filled with anything other than regular engine oil. S.A.E. 30 should be used regardless of season. To fill the transmission or check the fluid level, roll back the mat on the left side of the transmission tunnel and remove the rubber dust plug. The filler plug is now accessible and the fluid should be up to the bottom of the threads on the plug hole.

The shock absorbers are all refillable knee action type and can be checked for fluid level by removing the filler plug in the top of the shock body.

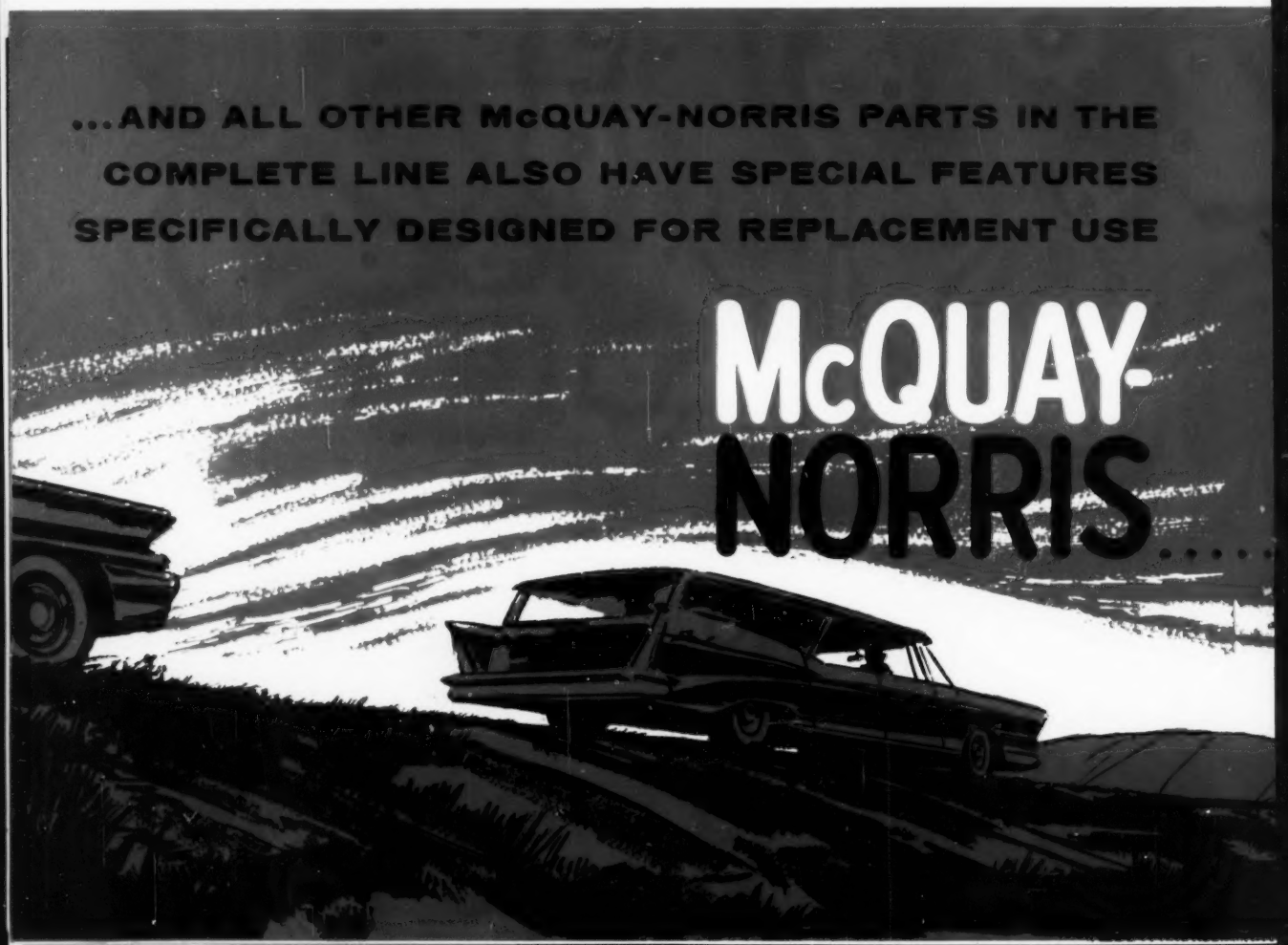
To insure full fuel pressure at the carburetors, the fuel line filter should be checked and cleaned. On the top of the mechanical fuel pump is a combination sediment bowl and filter screen. The screen can be removed for cleaning by unscrewing the bolt on top of the fuel pump and lifting off the top and screen.

MASTER CYLINDER SERVES BRAKES & CLUTCH

Power for both the brakes and the Sprite's hydraulic clutch originates in a rather unique combination master cylinder which is mounted on the fire wall above the steering column. Reserve fluid for both systems is stored in a single chamber in the top of the dual unit. The fluid level can be checked by removing the small cap at the top of the unit. It should be up to the bottom threads on the reservoir filler hole.

Free play in the clutch and brake pedals is controlled by the two nuts on the threaded rods at the front of the dual master cylinder. The clutch rod is the one closest to the fender. There should be about 3/4" free play in both pedals.

Since the hydraulic clutch mechanism is similar in design and function to a hydraulic brake system, it is also subject to many of the same maladies. If the clutch pedal is spongy, the system should be bled just like a brake system. On the side of the clutch housing is a small hydraulic cylinder, similar to a brake wheel cylinder, that activates the clutch. The


...AND ALL OTHER McQUAY-NORRIS PARTS IN THE
COMPLETE LINE ALSO HAVE SPECIAL FEATURES
SPECIFICALLY DESIGNED FOR REPLACEMENT USE
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bleeder valve is on this cylinder and accessible from beneath the car.

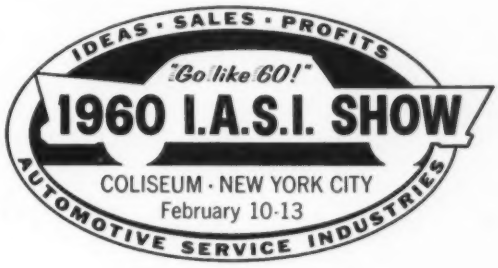
The brakes are conventional Lockheed hydraulics with dual leading shoes on the front, and single shoe with dual cylinders on the rear wheels.

To adjust the brakes, jack the car up and spin the wheel you're adjusting. While it's still moving, apply the brakes firmly. This will centralize the shoes in the drum, and must be done before the brakes can be adjusted properly. Remove the hubcap and line up the hole in the wheel with the slotted adjusting screw. Take a screwdriver and turn the screw clockwise until the shoe is tight against the drum. Back off until the shoe no longer drags, and repeat on the other adjustment. (There are two adjusting screws on the front wheels, but only one on each of the rear wheels.) The handbrake can be adjusted at the threaded linkage on the front end of the solid hand brake draw rod. Incidentally, when you lubricate one of these little jobs, don't overlook the grease fitting on the swivel arm at the rear of this rod. It's behind, and just to the left of the rear end.

ELECTRICAL SYSTEM

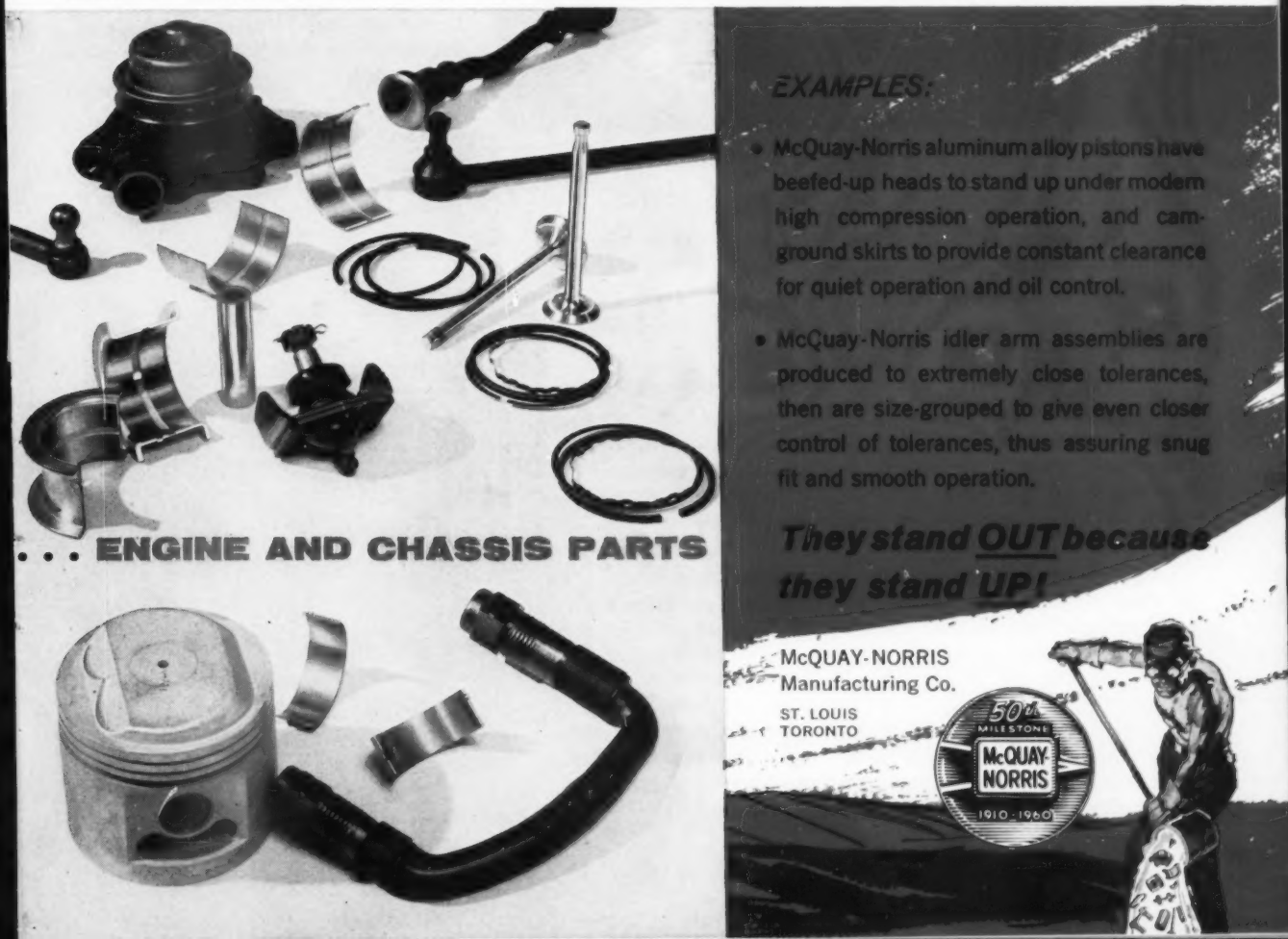
The voltage regulator and fuse block are mounted on the fire wall above and to the left of the clutch-brake master cylinder. Both fuses are 35 amp. tubular type and there should be two spares clipped upright in the fuse block.

The fuse nearest the voltage regulator protects the accessories that operate only when the ignition is switched on (stoplights, turn signals, fuel gauge, etc.), while the other protects all other electrical accessories that may be operated independently and are not affected by the ignition switch.



Removal of Door Check Spring Cures Hard-to-Open Rear Doors

If Plymouth owners complain that it takes excessive effort to open and close the rear doors on their 1960 cars, the factory recommends removal of the check spring from the lower hinge assembly of both rear doors. When spring has been removed, test operation of the door and striker.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• McQuay-Norris aluminum alloy pistons have beefed-up heads to stand up under modern high compression operation, and cam-ground skirts to provide constant clearance for quiet operation and oil control.
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What do I want in a Chisel or Punch"?

"I can tell you quick — I want 'em *tough*. I want a chisel that cuts clean. And I don't want to put it on a grinding wheel every time I use it. I figure if I pay good money for a chisel, it should last. Same thing goes for punches. I don't want a punch that snaps off the first time I give it a whack. When I say *tough*, I don't mean brittle-hard. You can get 'em so hard they chip and crack every time you hit them. A tool like that isn't worth a hoot. Let me tell you, it takes some makin' to make a good chisel or punch."

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There's no better time to weed out the old chisels and punches in your tool kit and get a master workman's assortment. Your *Snap-on* man can show you a set next time he's in your shop.

Snap-on set No. PC-170-K contains five starter punches and five drift punches 3/32 to 5/16 in., five chisels 13/32 to 7/8 in., and two sizes of center punches. Sizes are clearly marked on protective kit bag.

SERVICE MANAGERS

Be sure your mechanics read about this chisel-punch set.

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By HERB CARRIER
Detroit Editor

Runaway . . . rumble . . . wild ping . . . These are only some of the sounds and conditions that can exist in high compression engines. Understanding the cause and knowing what corrections to make is valuable knowledge when you are confronted with . . .

Mayhem in the mill

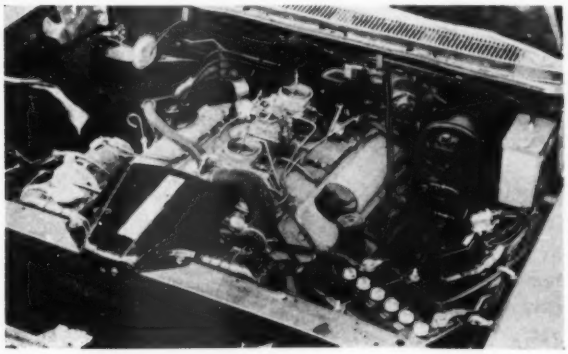
• STEPPING UP ENGINE compression ratios to and beyond the 10:1 mark has kicked the spark of life into a whole mess of nasty combustion quirks that were content to lie dormant at lower compression ratios.

The incompatable clamor for more economy and greater performance forced automotive engine designers into the higher compression bracket in order to get the "mostest from the leastest". Atomic acceleration plus eyedropper economy could only hope to be obtained by squeezing the daylights out of every speck of fuel that entered the combustion chamber.

COMPRESSION AND THERMAL EFFICIENCY

As compression ratio goes up, thermal efficiency —the engine's ability to convert gasoline's heat energy into work—goes up right along with it. For example, at 6:1 compression ratio, about 25% of the fuel's energy is converted into work. Raise the compression ratio to 8:1, and the 25% figure becomes 28%. At 10:1 compression ratio, it's possible to wind up with an engine rated at approximately 30% thermal efficiency.

Buried deeply within the heart of a modern, high-compression engine is the spawning ground of abnormal combustion. Knowing what operating condition produces which type of abnormal combustion and what he can do about it, if anything, is a must for mechanics.



The obvious answer to top performance and increased efficiency is higher and higher compression ratios. Experimental work in the research laboratories indicates the hand-in-hand increase of thermal efficiency and compression ratio peaks out at around 17:1. At this point, engine thermal efficiency is about 39%. Further increases in compression ratio result in a decline of efficiency. Today's average compression ratio is somewhere around 10:1. The ideal could be as high as 17:1. The current stalemate at 10:1 seems to be only a momentary delay while existing combustion problems are whipped.

There's little question about it, higher compression engines are excellent performers and are here to stay. But, some high compression engines operating under some conditions and with some fuels can produce the strangest sounds that ever came out from underneath a hood.

NORMAL COMBUSTION

In the lower compression ratios, nothing can compare with the mechanic with a golden ear in ability to detect unusual combustion sounds. Some old timers still insist on setting ignition timing by listening for the "ping". Unfortunately, the human ear is no longer effective for either detecting abnormal combustion or for setting ignition timing.

Within the combustion chamber of a modern automotive engine during normal combustion the chemical energy in gasoline is converted into heat energy through burning the gasoline. Some of the resulting heat energy expands to force the piston outward from the combustion chamber producing mechanical power, which, when properly transmitted, causes the vehicle to move.

For best efficiency, gasoline must "burn" in the right manner at the right time. For instance, firing of the spark plugs ignites the fuel at the exact instant it's supposed to happen. Then, the flame spreads across the combustion chamber evenly and smoothly. As it moves, it further compresses the unburned fuel-air mixture ahead of it. The unburned mixture ahead of the flame wall is called

the "end-gas". The end-gas is not only further compressed during the early stages of combustion, but it also receives considerable heat through radiation from the advancing flame.

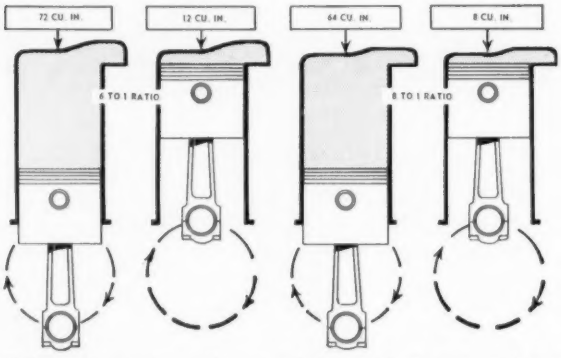
Normally, the end-gas temperature and pressure remain low enough so that the flame front can advance smoothly across the entire combustion chamber and consume all the fuel. Under these conditions, the combustion process is completed with no violent explosions and no audible knocks.

ABNORMAL COMBUSTION

In high compression engines, many factors exist which can hamper and prevent normal combustion. Extensive study and research of the abnormal combustion problem has, among other things, resulted in a concise cataloging of sounds by name and characteristic:

> **Spark Knock,** ***As defined by the Coordinating Research Council is, "A knock which is recurrent and repeatable in terms of audibility. It is controllable by the spark advance. Advancing the spark increases the knock intensity. Retarding the spark reduces the knock intensity."***

In effect, a spark knock is caused when the end-gas ignites before the flame front gets to it. This

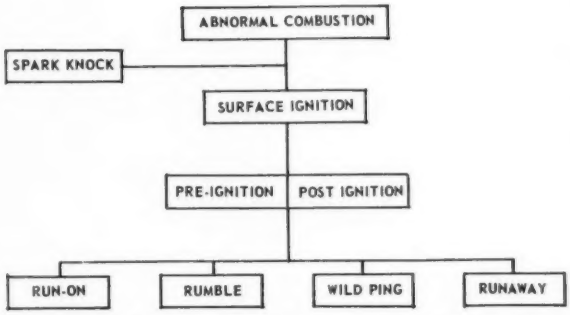


Raising compression ratios, even beyond the 10 to 1 mark has caused ornery combustion gremlins—content to remain dormant, with lower ratios.

action is called "self-ignition" or "autoignition." When this happens, the end-gas burns up to 25 times faster than normal and produces high-frequency pressure fluctuations, which, in turn, produce the sharp metallic noise called "spark knock."

Excessive spark knock is objectional from a noise standpoint, and it can actually cause physical damage to the engine. Also, the vibrating gases, which cause the knock, increase heat loss from the combustion chamber resulting in an overheated engine and loss of power and efficiency.

> **Surface Ignition,** ***as defined by the Coordinating Research Council is, ". . .***



Coordinating Research Council terms for combustion phenomena in motor vehicle engines, especially various types of abnormal combustion, explained in the article.

> ***the initiation of a flame front by any hot surface other than the spark discharge prior to the arrival of the normal flame front. The flame front or fronts so established propagate at normal velocities. This phenomenon can be further subdivided into preignition and postignition."***

Surface ignition is usually caused by overheated valves or spark plugs, by glowing deposits in the combustion chambers or any source other than the normal spark ignition.

Spark knock and surface ignition are the two big divisions of combustion noises. In the case of spark knock, the remedy is simple: First, adjust the ignition timing and distributor advance mechanisms to eliminate the knock. Second, use fuel of a sufficient octane rating to prevent spark knock.

DETERMINED BY MANUFACTURER

The specifications for correct ignition timing of an engine are determined by the manufacturer. Usually, this reflects a compromise, but is the best all-around timing. On particular engines within the identical make and model lines, the manufacturer's specifications can be varied slightly when necessary for maximum performance and suitability to available fuels. Once the proper initial ignition timing and the correct advance characteristics are determined, any existing spark knock is the fault of the fuel's inability to resist knocking. The measurement of gasoline's resistance to knock is its **octane** rating.

The octane requirement of an engine depends on how its design and the conditions under which it operate affect the temperature and pressure of the end-gas in the engine, and the time required for the flame to burn the fuel-air charge.

COMBUSTION CHAMBER DEPOSITS

To a certain degree, engine combustion chamber deposits also affect the engine's octane requirements. When an engine is new and "clean," it has specific combustion characteristics that dictate the use of a fuel with definite octane rating. As the

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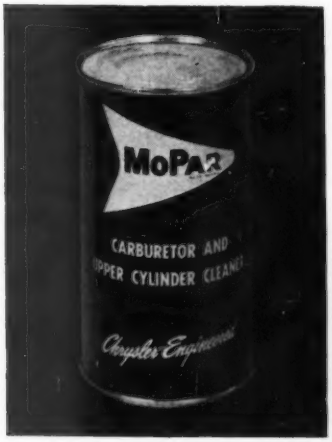
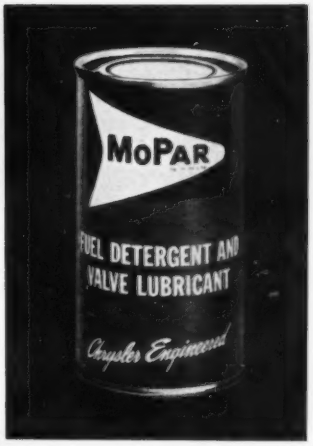
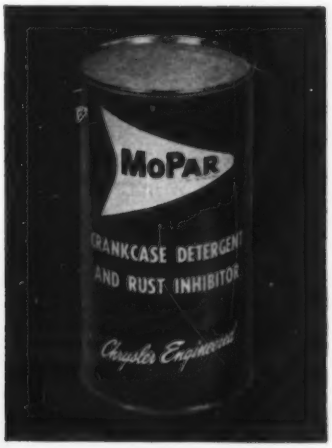


MoPar Carburetor and Upper Cylinder Cleaner. Poured directly into carburetor throat, cleans out passages, frees sticking valves and rings, leaves protective film on all upper engine parts. *Part No. 1643 273 (16-oz. can).*

MoPar Fuel Detergent and Valve Lubricant. Poured into gas tank, it helps protect fuel system from carbon deposits. Helps rustproof carburetor, fuel tank, intake manifold, combustion chamber. *Part No. 1643 272 (6-oz. can).*





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MoPar PARTS AND ACCESSORIES

MoPar Division, Chrysler Motors Corporation
Detroit 31, Michigan

Sell the line that keeps your customers sold on you—MoPar

Runaway surface ignition is a most destructive type of surface ignition leading quickly to damage, such as piston head holes, broken ring lands and so on.

engine is operated under conditions which lead to incomplete combustion of the fuel, ash tends to accumulate in the combustion chamber. Some lubricating oils and their additives also contribute toward the accumulation of ash deposits. These residue products, when not properly purged and exhausted from the engine, tend to pile up within the combustion chamber. This is undesirable because such deposits raise the effective compression ratio and also raise the temperature of the incoming fuel-air mixture.

A "dirty" engine requires higher octane fuel than a "clean" engine when all other conditions are equal. A compensation can be made, of course, by retarding the initial ignition timing, but this is usually at the sacrifice of performance. It's also important to have the engine's cooling system operating efficiently. An engine that "runs hot" requires higher octane fuel because of the increased temperature of the fuel-air mixture.

The effect of compression ratio, engine design, spark timing, and gasoline octane rating on producing or eliminating spark knock has been known for many years. Spark knock, per se, is of very little trouble on modern, higher compression engines.

SURFACE IGNITION

With the advent of modern, higher compression engines, the problem of surface ignition became very real. Generally, surface ignition means that the fuel-air mixture is ignited by some hot surface within the combustion chamber rather than by the high tension current passing through the gap between the spark plug electrodes.

When the surface ignition takes place **before** the spark ignites any portion of the fuel-air mixture, it is called **preignition.** When the phenomenon occurs **after** a portion of the fuel-air mixture has been ignited by the spark, it is called **postignition.** It may produce a single flame or many flames. And, either condition may or may not cause audible engine noise. The mere absence of combustion noises does not necessarily indicate normal combustion. Inaudible abnormal combustion is perhaps more dangerous because it can result in power loss and destruction of engine components and is very difficult to detect.

Surface ignition breaks down into many subdivisions. Basically all types of surface ignition may be thought of as being caused by overheated surfaces within the combustion chambers. Iron oxide scale which has formed on valve heads and spark plugs is the prime source of surface ignition.

Some forms of hot-surface ignition can be prevented by selecting spark plugs of the proper heat range, but this requires careful thought and understanding. If a "hot" plug is used to discourage deposit formation on the plug's insulator during light-duty driving, the plug may become hot enough to cause preignition during high-speed driving or when driving under heavy loads, such as hill climbing or towing a trailer. If a "cold" plug is used to overcome preignition during high-temperature operation, the plug may foul under light-duty conditions.

Deposit Ignition: Research indicates deposit ignition depends, in part, on the make-up of fuels and lubricating oils. In gasoline, the high-boiling hydrocarbons are the worst offenders. These comparatively "heavy" fractions of gasoline not only tend to produce greater deposit build-up but also are more prone to autoignite the fuel-air charge within the combustion chamber. Research also indicates that some multigraded oils tend to produce less surface ignition than do oils containing heavy ends.

Knocking Surface Ignition: Surface ignition is most often accompanied by an audible knock. The knock is a result of the activity between the flame front and the end-gas. Surface ignition knock is unlike spark knock, however, in that knocking surface ignition is frequently erratic, and occurs in spurts rather than in a repeated pattern. Knocking surface ignition can usually be eliminated by increasing the octane number of the fuel, but in most cases, fuel of higher octane rating will be required to eliminate surface ignition knock than is required to overcome spark knock. Unlike spark knock, surface ignition knock cannot be controlled by initial ignition timing.

In the chemical industry, fuels and lubricating oils are engineered to minimize formation of the types of deposits that are most likely to cause surface ignition. Most gasoline refiners use a phosphorus additive in the gasoline. This type of additive changes the deposits into compounds which have less tendency to glow, and consequently, cause less autoignition.

(Continued on page 62)

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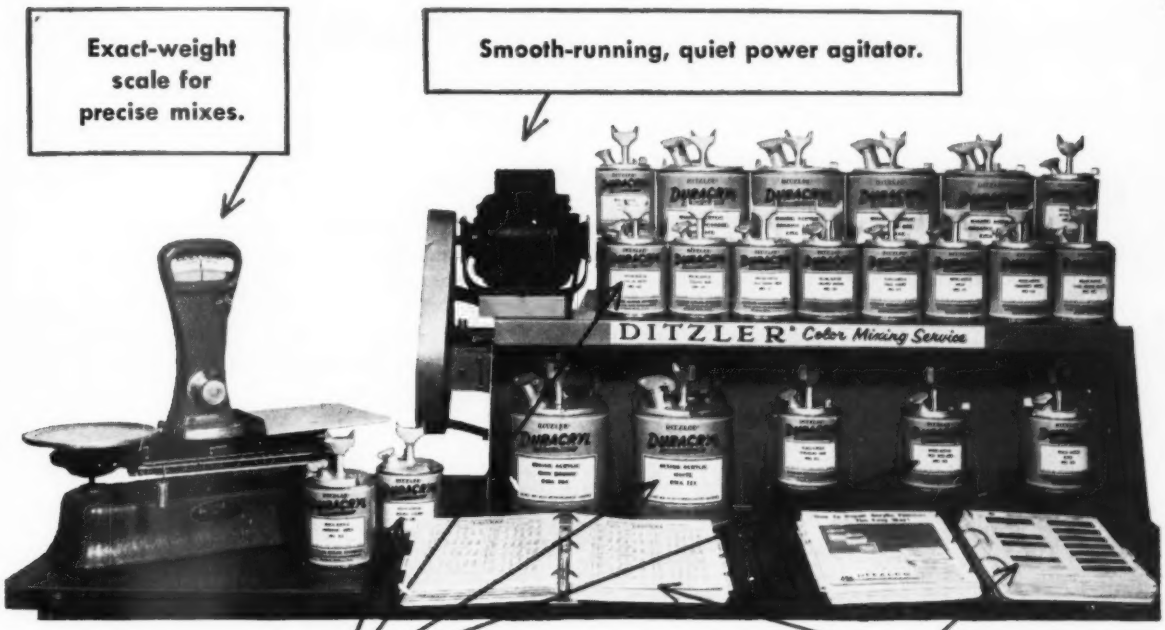
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The transistor

An electronic marvel that has practically become a household word now promises to play a big part in the electrical system of motor vehicles.

• THE THEORY OF HOW the transistor functions is quite involved and requires an understanding of the electron theory in order to explain its operation. However, it is not too difficult to explain what it does and to give its possibilities.

In short, a transistor is a device which makes use of certain electronic characteristics so that a very weak electrical current can control a much more powerful current. At this time, transistors with capacities up to 25 watts are available, but there is little doubt that within a short time there will be units with much greater capacities available.

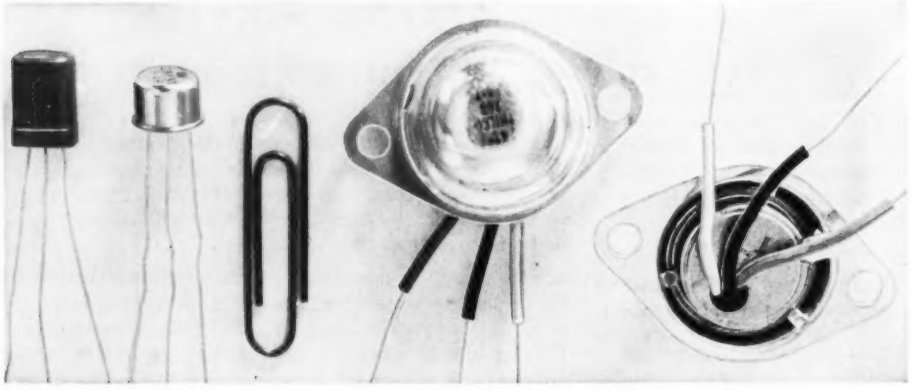
In appearance, one type is about the size of a grain of field corn and somewhat the same shape, with three wires attached to it for connection purposes. These wires are named for the part of the transistor to which they are attached—the collector, the base and the emitter. Other types are round, some of the larger ones being about the size of a twenty-five cent piece, and up to one half inch thick.

As can be inferred from the three names (collector, base, emitter) there are three parts to the transistor in addition to its housing or casing and connecting wires. These three parts of the transistor are two thin slices of germanium crystal impregnated slightly with an impurity such as boron, galium or indium for the P-type (positive type) or arsenic for the N-type (negative type) with a somewhat thicker slice of germanium crystal in the middle, or base position. The two outside slices are respectively the collector and the emitter. The three parts are in intimate electrical contact.

Germanium is a metal and is the type of material called a "semi-conductor", which means that under certain conditions it will become a conductor of electricity.

There are two types of transistors in general, describe das P-N-P or N-P-N, depending on whether the two outer slices are positive or negative, with the center slice of the opposite polarity.

The action of a transistor is similar to the vacuum tube used in radio and television sets. In the vacuum tube there is a filament (heated electrically), a plate and grid. When the filament is heated, a stream of electrons flows from the filament to the plate, which has an electrical bias so it will attract the electrons. The grid is inserted directly in the path of the electrons and if a signal voltage is impressed on the grid it will influence the flow of electrons from filament to plate in proportion to the strength of the signal.



Three different transistors. At far left is one shaped somewhat like a grain of corn. Next is one of about the same capacity but with a round housing. On right are shown top and bottom of a larger transistor. The three wires are connected to the emitter, base and collector, respectively. Paper clip gives an idea as to size of the units.

Variations in signal strength, such as those resulting from sounds of music or speech, in suitable audio circuits (even though they may be very weak, when impressed on the grid) will have the effect of greatly amplifying the signal at the plate and its connections in the circuit.

No current will flow through the transistor unless and until there is an electrical bias (produced by a battery), flowing between the emitter and the base. Any variations in the bias current flow, such as the signal referred to in the case of the vacuum tube (which is a relatively weak signal), will be reflected in the current flow through the transistor. Therefore, if a signal is impressed on the bias circuit, it will be amplified in the output current. This characteristic makes it possible, in correctly designed circuits, to use transistors in much the same way that vacuum tubes are used. The transistor can also be used as a switching device: By interrupting the bias current, flow through the transistor will be interrupted.

COMPARABLE TO RELAY CIRCUIT

The transistor may be compared to a relay circuit. In the relay, a weak current will operate the magnet to close a switch that will carry a much more powerful current. In the transistor, a weak current flowing from emitter to base triggers a much more powerful current which will flow through the transistor.

Useful applications offered by transistors are astounding, and new uses are found for this valuable device almost daily. Right now, transistors are being widely used in radio sets and to some extent in television. Their use in electronic computers and in industrial control devices is spreading rapidly.

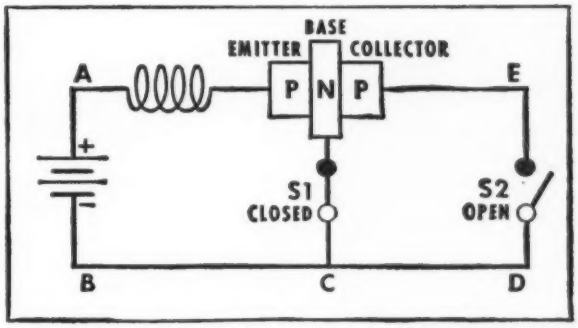
SEVERAL ADVANTAGES

The advantages of the transistor are several in number. The power requirement is practically nil, as there is no filament to be heated. The transistor is much smaller than a comparable vacuum tube, allowing smaller units or appliances to be made than where tubes are used. Their service life is longer as there is no filament to burn out or glass shell to break.

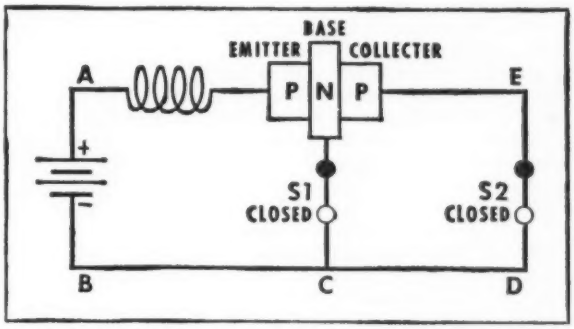
The science of electronics is developing so rapidly that a book on the subject written last year is already out of date. New developments are being made right along and new applications are being worked out so quickly that it is difficult to keep up with them.

Delco-Remy now has a fully transistorized voltage regulator for use with their rectified AC generator, as well as a regulator using one transistor in conjunction with vibrating points.

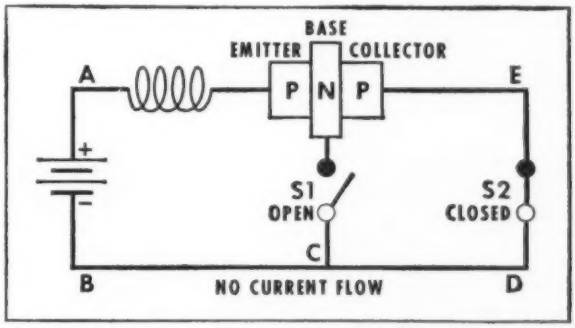
The new type of ignition system announced a short time ago by Electric Autolite makes use of a transistor. It is anticipated that within the next two years there will be important changes in automotive electrical systems as further applications of the transistor are developed.



Basic circuit similar to the one used in Delco-Remy transistorized regulators. When a transistor is connected into the circuit as shown, no current will flow when switches S1 and S2 are open. When switch S1 is closed there is forward bias with current flow through the emitter-base circuit A-N-C-B. For purpose of illustration, assume a current value of 4.5 amperes. The collector circuit is inoperative because switch S2 is still open.



With both switches closed the total current remains at our theoretical 4.5 amperes, but most of the current leaves the transistor through the collector circuit while remaining current leaves through the base circuit. Base current will be about .35 amperes while the collector current will be approximately 4.15 amperes, flowing through N-E-S2-D-C. Thus the collector circuit carries about 12 times as much current as the base circuit.



With switch S1 open and switch S2 closed, no appreciable current will flow. The absence of emitter-base current has the effect of "shutting off" emitter-collector current. Thus the emitter-base circuit can be used to "trigger" the base-collector circuit. With both switches closed, resistance of the transistor is negligible, but if S1 is opened, cutting off base current, the emitter-collector resistance becomes very high, with practically no current flowing.

The silicon diode rectifiers used on the latest AC generators apply some of the same principles that are used in the transistor, and more applications are being worked out in the various research laboratories engaged in this type of development.

Designed and built to carry varied electrical loads without excessive resistance—often working in unseen locations and taken pretty much for granted—that's the role of...

Switches in motor cars

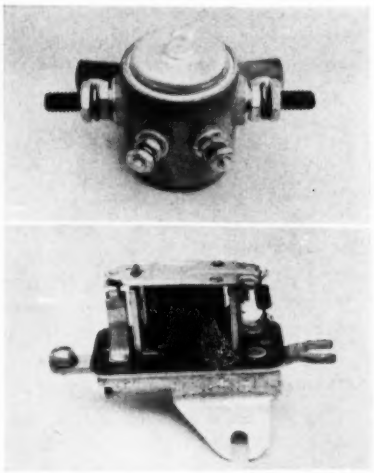
By FRANK WEST

• MUCH LIKE A CHAIN, an operating electrical circuit is only as good as its weakest link. The latter might be some unit like a generator, a cable, connection or a switch. Of these three, let's discuss switches.

A switch is basically a device which opens and closes an electrical circuit. We often think of switches as those which we operate manually. But there are also mechanically operated switches, such as those actuated by door movement; governor switches, used on over-drive systems; pressure actuated switches, such as the one that controls the stop light; thermostatic switches, such as used on the Holley dash instruments on Ford products. And, there are relays by which a circuit carrying a light current opens and closes a switch which carries a much heavier current.

Switches must stand up under years of use. The fact that they give so little trouble is a tribute to their makers. They must be designed so that even after years of use, there will be a minimum voltage drop as the normal current flows through them. A resistance which causes a drop of even 0.1 volt is too much.

In the automotive electrical system, probably the hardest working and extremely critical switches are the primary circuit contact breakers, two typical ones being shown below.



Top: Cranking motor solenoid switch, main terminals of which connect to battery and cranking motor. Other unit is cut-out relay used on 3-brush generators on some tractors and stationary engines. It's an automatic switch actuated by current flow through the series current coil and the shunt voltage coil.

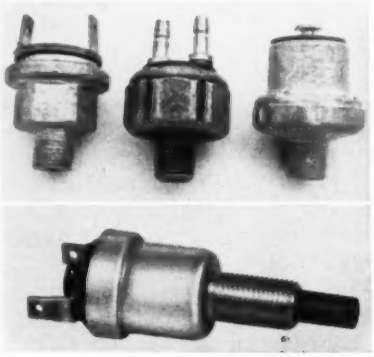
Dependable as switches are in general, they will, after long periods of use, wear, and may introduce excessive voltage drops in circuits. Therefore, where there are any symptoms of circuit trouble, the voltmeter should be used to pinpoint the trouble spot. This is quick and easy to do by touching the meter leads to any two points in the live circuit between which there may be a suspected abnormal voltage drop. To check a switch, current must be flowing and the meter leads must be in contact with the two terminals of the switch. If the switch is somewhat inaccessible, the wires leading to it can be contacted. In this case the connections to the switch must be clean and tight. Otherwise it will be difficult to tell whether the voltage drop is in the switch itself, in the cable or wiring, or in the connections to the terminals. The lowest reading scale on the voltmeter should be used, for example, the 0-3 volts scale which reads in 10ths of a volt or finer.

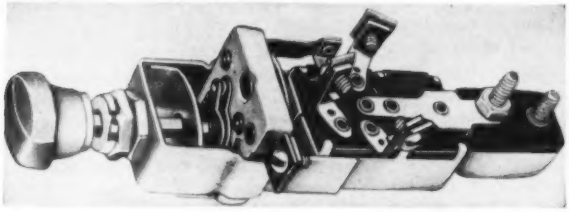
Besides connecting the voltmeter across the switch, readings can be taken from each side (terminal) of the switch to ground, and noting the difference between the two readings. The same ground should be used for each reading.

If a switch is suspected of being faulty, it can be checked by running a jumper directly from the battery to the appliance, by-passing the switch. If the appliance works with the jumper in place, but does not work with the switch "On," it shows that there is trouble in either the switch, its connections, or the circuit wires.

Car mileage is a fairly good indicator of the probability of impending switch trouble, because the use switches get is roughly proportional to car use. Because of their relatively low cost and the difficulty of opening up and repairing them, switches are generally replaced when decreased efficiency or failure is noted. The ignition distributor breaker points can of course, be easily inspected for condi-

Top (left to right): Vacuum safety switch; pressure actuated stoplight switch; low oil pressure switch to control light in series with ignition switch. Below: Mechanical stoplight switch.

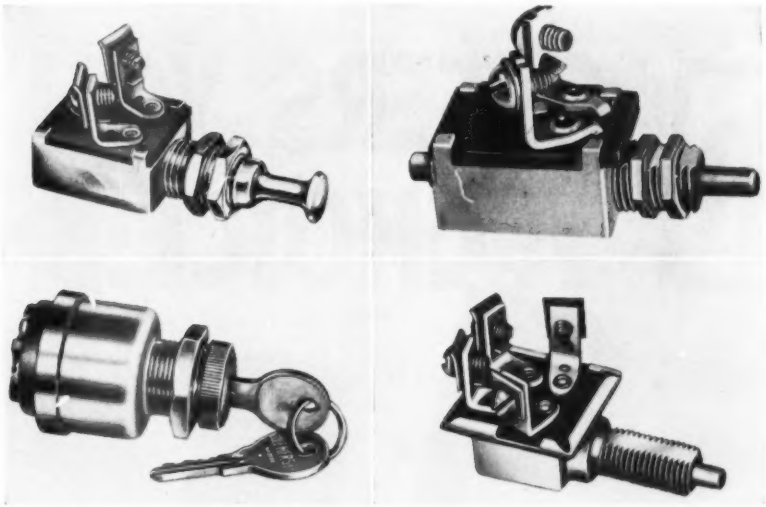




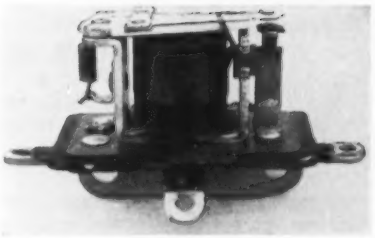
Push-pull headlight switch with rheostat (for panel lights) and circuit breaker.

tion, but most switches are enclosed.

The stoplight switch gets about the most frequent use of any of the switches, as it is actuated every time the brakes are applied. Consequently it is replaced more often than any of the others. As this switch is not grounded and is in series with the hot wire leading to the stoplights, it is easy to check by merely shorting the two switch contacts, thus by-passing the switch. If the stoplights come on when the two terminals are connected, but will not light on brake application, the switch is defective and must be replaced. With the later model cars which have the brake master cylinder and stoplight switch mounted on the fire wall, the switch is accessible and can be changed in a matter of minutes.



Upper left: Push-pull switch for varied use-driving light, heater motor, etc. Upper right: Door switch to operate dome light and others. Lower left: Ignition switch, which may have 2, 3 or 4 positions for ignition, starting relay, accessories, etc. Lower right: Overdrive kickdown switch to cut out overdrive upon flooring accelerator pedal.

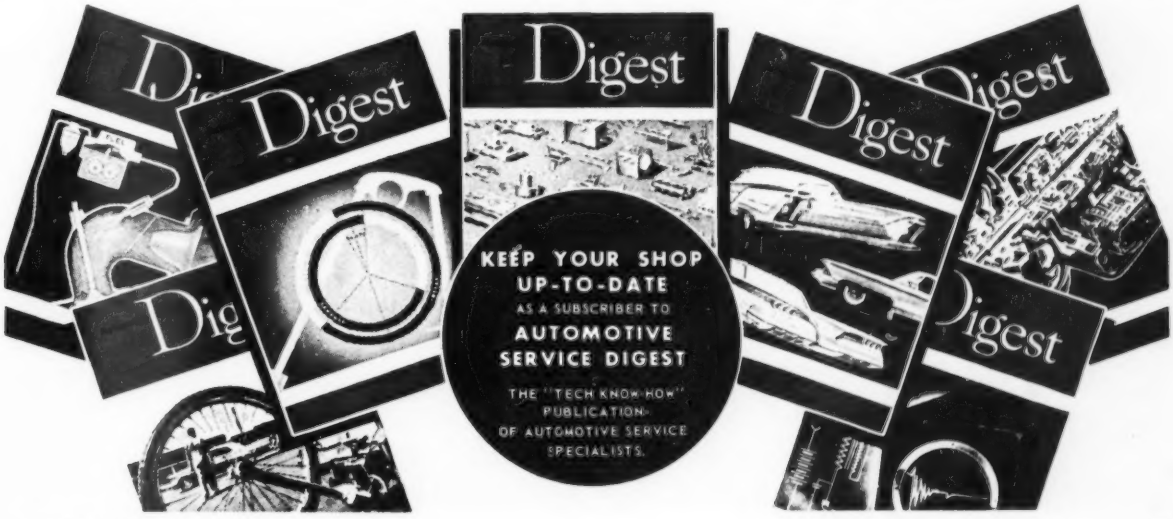


Relay switch for lights, horn, etc. Left contact goes to relay control switch, magnet winding and to ground. Other 2 terminals are in series with the electrical load.

Be sure the ignition switch is "on" when the test of the switch is made. If the stoplights do not come on when the terminals of the switch are shorted across, it is probable that the circuit is dead. Check this by using a test light or voltmeter from the battery side of the switch to ground. If the circuit is hot, the test light will light up or the voltmeter will show substantially battery voltage. Remember that the stoplight circuit comes through the turn signal circuit, so if the circuit is dead there may be trouble in the turn signal switch.

CIRCUIT BREAKERS

A number of switches are equipped with circuit breakers instead of fuses. The circuit breaker is designed to open and close intermittently when its rated amperage is exceeded. The advantages of the circuit breaker include no need for replacement when a short or overload is corrected, inconvenience of replacing it with one of greater capacity, as can be done with a fuse. It is convenient to have a circuit breaker on the switch in the circuit it is designed to protect, as it makes it easier to identify and trace trouble.



Automotive Clinic . . .

(Continued from page 8)

torque would be given to spinning wheel.

Would you please straighten me out on this point of power and torque output in a rear axle.

—J.D.E., Los Angeles, Calif.

Answer: Torque on each axle shaft will be the same, since the power is applied to the shafts through the differential pinion gears, which act as levers to apply balanced torque. This will vary somewhat in the case of one wheel being on ice with the other one on dry pavement, when the pinions will merely roll around on the stationary axle gear, driving the other gear.

In regard to the power received by each wheel, with equal torque, the horsepower will be proportional to speed, so the faster wheel will receive more power and the slower wheel less.

As we see it, the question is merely one of equal torque on the two axle shafts with power proportional to wheel speed. If one wheel slips slightly the torque may not be equal on each wheel, but there are so many variables possible in this connection that it is difficult to arrive at any accurate figures, depending on tire tread, type of pavement, amount of wheel bounce, wet, icy or snowy surface, speed, curves, etc.

8-Volt Battery

Can you tell me the proper wiring hook-up for an 8-volt battery on a 1952 Cadillac. What type of resistor will be used, and what voltage should regulator be set at?

Also tell me how to hook up an 8-volt battery on the same car for starting, but using a 6-volt take-off for ignition and accessories. What would be the voltage regulator setting in this case?—*E.G., Pawtucket, R.I.*

Answer: We do not recommend the use of an 8-volt battery. If the 6-volt battery and the electrical equipment are in good shape, the engine should start easily. However, we do know that a number of 8-volt batteries are being used with satisfactory results, where proper precautions are taken.

Two resistors and two by-pass conductors are required. A 0.12 ohm resistor should be inserted in the circuit at the starting motor switch (live

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side) where the conductor that picks up the light and accessory current is connected, putting the resistor in series with this wire and the 5/16″ binding post on the starting motor where the end of the hot battery cable is connected.

Another resistor (0.25 ohms) should be inserted in the ignition circuit on the battery side of the coil. This puts the two resistors in series for the ignition circuit.

There will be variations in the voltage drop across the 0.25 ohm resistor in the light and accessory circuit, depending on whether the lights, radio, heater motor, etc., are turned off or on. The actual voltage will run from about 8 to 6 volts, which is within the rated voltage of the electrical equipment on 6-volt systems.

The voltage regulator should be set for 9.6 volts and the cut-out relay to 8.5 volts. No adjustment is required on the current regulator.

It is necessary to install an additional conductor to the charging system to by-pass the resistor so that full generator voltage can get to the battery without going through the resistor. This conductor goes from the B terminal on the voltage regulator to the battery side of the starting motor where the live battery cable is connected. The wire which is presently connected to the B terminal should be disconnected and carefully taped to insulate it, as it will not be used further, being replaced by the new conductor. The old wire runs through the wiring harness and it will be difficult to find and connect to the battery side of the resistor.

It is advisable to add another conductor from the battery side of the coil to the relay switch connection on the starting motor switch so that when the cranking motor is working this new conductor will by-pass the resistor in the ignition system so that full battery voltage can get to the coil. You will recall that when a battery is operating the cranking motor there will be a voltage drop of 1.5 to 2.0 volts, so that with the by-pass the coil will get full 6 volts with starter operating. With the starting circuit broken, the by-pass is also broken and the resistor will again reduce the ignition voltage.

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Automotive Service Digest

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Brake Drum Lathe

This new Model B-700 "Jobber's Special Brake Drum Lathe", recently announced by The Barrett Equipment Co., has a capacity of from 6" to 24" diameter brake drums with a full carriage travel of 7 1/16". It features Timken bearings, heat-treated arbors, tool carriage with adjustable gibs,

three speeds and two feeds. Power is supplied by a heavy-duty ¾ hp. motor with conveniently located belt drive for instant change of speeds. The unit is mounted on a heavy steel, streamlined base which includes a storage compartment for adapters and supplies. All adapters and accessories are interchangeable with those used on the B-500 Series Drum-Dokters.

(Circle No. 1 on Reader Service Card)

Tire Valve Replacement

A new line of self-vulcanizing replacement tire valves is announced by A. Schrader's Son which are said to make tube valve replacement as easy as patching a tube—and without the need of heat, smoke and vulcanizing compounds.

To apply, the red protective cover is peeled from the replacement valve. An evenly spread coat of Schrader Self-Vulcanizing Fluid is applied to

the buffed tube stock and the new valve is applied. The valve base is pressed firmly in place and the tube is repaired—ready for immediate use.

(Circle No. 2 on Reader Service Card)

Pitman Arm Puller

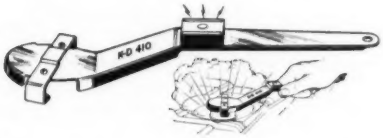
Fast and easy removal of pitman arms is said to be possible with the new Model 439 Pitman Arm Puller being offered by the John Bean Division, Food Machinery & Chemical Corp.

The new tool is a Cadaloy, heat-treated casting and has a steel screw for maximum strength and durability. It provides a ball bearing contact at the end of the sector shaft to eliminate burring of threads.

(Circle No. 3 on Reader Service Card)

Radiator Cap Wrench

Removing and replacing radiator caps is said to be completely safe, no matter how tight the seal, when



this K-D Radiator Cap Wrench is used.

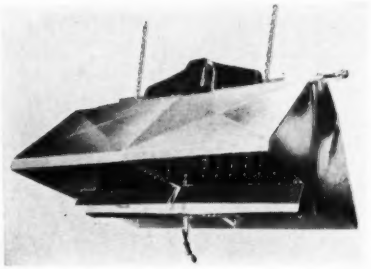
A permanent magnet, built into the handle, holds wrench to any steel surface when not in use. While radiator is being tested or filled, the cap is held in the tool and hung on gas pump, fender, etc., leaving both hands free and eliminating possibility of misplacing radiator cap.

(Circle No. 4 on Reader Service Card)

Hooded Infra-Red Heater

The Panelbloc Division of the Bettcher Manufacturing Corp. has announced development of a new type gas fired infra-red radiant generator.

The hooded units feature a bright aluminum hood, which replaces the customary louvers. Design of the hood is such that it concentrates the heater output into a denser radiant



beam, which, in turn, permits higher mounting height.

The hooded Panelblocs may be hung seven feet higher than the standard model, and, according to the manufacturer, still cover approximately the same area, with the same radiation intensity on the floor as the louvered heater.

The new units will continue to utilize self-energizing controls, so that hanging, piping and flue connections are all that is required to complete installation. (Electrical connections are not necessary.)

(Circle No. 5 on Reader Service Card)

Wagner Lockheed

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These are new *manufacturers' products*

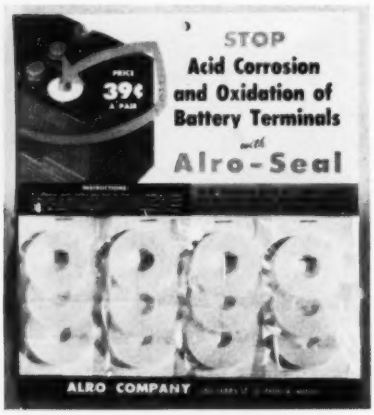
Spark Plug Tester

With the new Model 432 King Spark Plug Tester, the manufacturer states that inefficient and defective spark plugs can be located either when installed or removed from the vehicle engine. In addition to testing spark plugs, the patented electronic power supply may also be used to locate cross-fire and leakage in the vehicle hi-tension wiring, distributor cap or rotor.

(Circle No. 6 on Reader Service Card)

Battery Terminal Seal

Battery terminal seals molded of polyethylene plastic are being offered by the Alro Company which are said to stop acid corrosion and oxidation of



battery terminals due to acid creepage up the terminal posts.

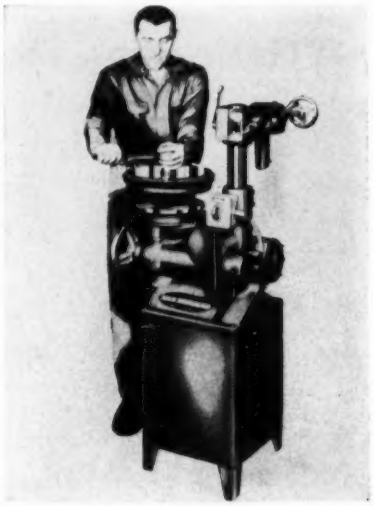
They are easily and quickly installed on any battery and come packaged on display cards containing either 1 set or 12 sets of seals.

(Circle No. 7 on Reader Service Card)

Vertical Drum Lathe

An entirely new vertical-type brake drum lathe which occupies less than two square feet of floor space is announced by the Van Norman Machine Co.

Known as the Model 301 "Re-Tru" drum lathe, it is especially designed for service shops with limited work space and personnel. Automatic feed and shut off and handy controls for positioning tool bar into drum make operation easy and simple. Standard

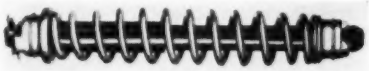


equipment includes a built-in drum micrometer, ½ hp motor, switch and necessary wrenches and belts.

(Circle No. 8 on Reader Service Card)

Car-Buoy Corrects Rear-End Sag

According to Moog Industries, Inc., sagging rear-ends of modern automobiles tend to shorten the life of tires, springs, shocks and tailpipes and cause dangerous side sway on curv-



ing roads. In addition, at night the headlights of cars with sagging rear-ends, send their light beams upward, reducing driver visibility and blinding drivers of on-coming cars.

To overcome this difficulty, the manufacturer is offering The Car-Buoy, a pair of calibrated steel coil springs coated with a heavy rubber-like plastic coating that slides over the rear shock absorbers to add greater comfort and safety. Special bracket design is said to cradle the stress and put the weight on the shock mounting, not on the shock welds.

(Circle No. 9 on Reader Service Card)

Automatic Nozzle Repair Kits

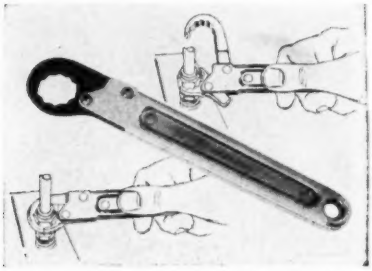
Jack-Pack Mfg. Co. announces two "Repair-it-Yourself" automatic nozzle repair kits, with which it is said to be possible to repair all OPW and Buckeye automatic nozzles.

Known as Noz-1-Pack, both kits contain the most commonly replaced items needed to restore trouble-free nozzle operation and efficiency.

(Circle No. 10 on Reader Service Card)

Ratcheting Tube Wrench

A new light-weight ratchet wrench which is said to speed assembly of tube fittings and be ideal for work in close quarters, is now available from The Imperial Brass Mfg. Co.



Known as Kwik-Tite Ratchet Wrenches, they are said to be simple and fast to operate. You simply place the wrench jaws over the side of the nut and lift handle slightly. The wrench will snap closed (illustration) and ratchet. To remove, you simply apply slight hand pressure, moving the wrench handle forward and down, which causes jaws to snap open. Wrench needs only 30° handle movement to get a new grip on nut.

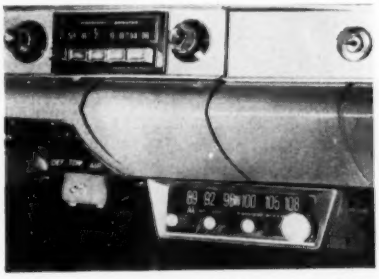
The Kwik-Tite Wrenches are available in the following hex nut sizes: $\frac{3}{8}$", $\frac{7}{16}$", $\frac{1}{2}$", $\frac{9}{16}$", $\frac{5}{8}$", $\frac{11}{16}$", $\frac{3}{4}$", $\frac{13}{16}$" and $\frac{7}{8}$".

(Circle No. 11 on Reader Service Card)

Transistor-Powered FM Radio

Responding to a long expressed demand of American motorists who enjoy its more specialized programming, Motorola Inc. announces production of a transistor-powered FM car radio.

Compact in size and designed for



under-the-dash installation, the Motorola FM-900 has been engineered as a complete unit, including its own speaker, to operate independently of or in addition to the car's AM set. The set is capable of reproducing the full range of audio transmitted by an FM station from 50 to 15,000 cycles per second and boasts 15 watts of power.

(Circle No. 12 on Reader Service Card)

DASHPOT

The dashpot, which helps to prevent engine stalling, needs periodic replacement... adding to your profit

JACKPOT

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ADVERTISERS IN THIS ISSUE

Advertiser	Key Number
BEAN DIVISION, JOHN	100
BEAR MANUFACTURING CO	101
BISHMAN MANUFACTURING CO.	102
BOSCH CORPORATION, ROBERT	103
BRAKE PARTS SPECIALTY CO.	104
CABOT, INC., SAMUEL	105
CARTER CARBURETOR DIVISION OF ACF INDUSTRIES	106
CHRYSLER MOTOR PARTS DIV. (MoPar)	108
COLE-HERSEE COMPANY	109
DELCO-REMY DIVISION	110
DITZLER COLOR DIVISION	111
DUALMATIC PRODUCTS COMPANY	112
DuMONT LABORATORIES, INC., ALLEN B.	113
EIS AUTOMOTIVE CORP.	114
ELECTRIC AUTOLITE COMPANY	116
F. & B. MANUFACTURING CO.	115
HASTINGS MANUFACTURING CO.	117
INGERSOLL-RAND COMPANY	118
INLAND MANUFACTURING CO.	119
KEN-TOOL MANUFACTURING CO.	120
McQUAY-NORRIS MANUFACTURING CO.	121
MASTER TECHNICAL PRESS	122
OTTO ITEMS, INC.	123
PERFECT CIRCLE CORP.	124
PERMATEX COMPANY, INC.	125
PRACTICAL MANUFACTURING CO.	126
RAJAH COMPANY	127
RAMSEY CORPORATION	128
ROCHESTER PRODUCTS DIVISION	129
SCHWARTZ MANUFACTURING CO.	130
SHURHIT PRODUCTS, INC.	131
SNAP-ON TOOLS CORP.	132
STANDARD MOTOR PRODUCTS, INC.	133
STUDEBAKER TAXICAB CORP. OF MANHATTAN	134
SUN ELECTRIC CORPORATION	135
TIMKEN ROLLER BEARING CO.	136
TRIPPE MANUFACTURING CO.	137
UNIQUE PRINTED PRODUCTS CO.	138
WAGNER ELECTRIC CORP.	139
WINONA TOOL MANUFACTURING CO.	140

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3	11	19	27	35	43	51	59	67	75	83	102	110	118	126	134	142	150	158
4	12	20	28	36	44	52	60	68	76	84	103	111	119	127	135	143	151	159
5	13	21	29	37	45	53	61	69	77	85	104	112	120	128	136	144	152	160
6	14	22	30	38	46	54	62	70	78	86	105	113	121	129	137	145	153	161
7	15	23	31	39	47	55	63	71	79	87	106	114	122	130	138	146	154	162
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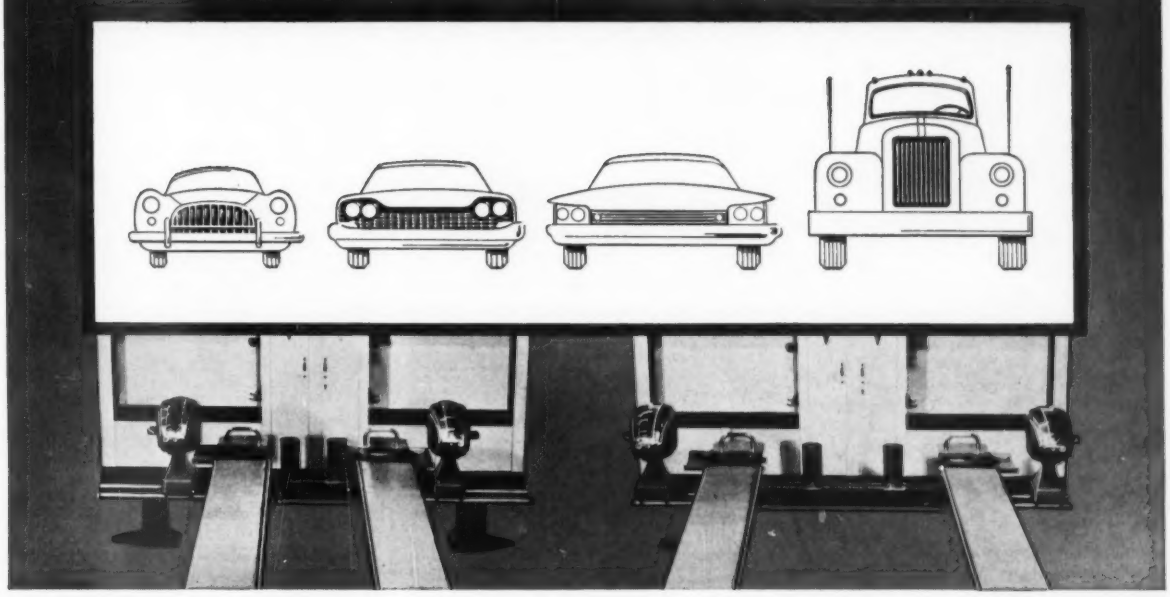

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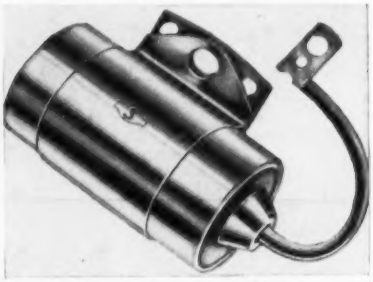
These are new *manufacturers' products*

Shockmaster Condenser

A new automotive condenser, called the Shockmaster, has been developed by Standard Motor Products, Inc., who claims that its unique "total encapsulation" process makes the con-



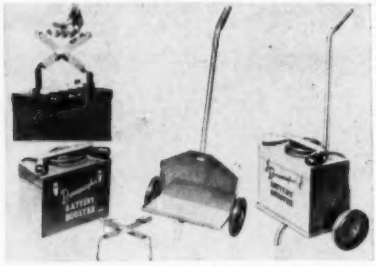
denser impervious to vibration and moisture. A combination of welded internal leads, internally soldered ground-tab and a 1000-volt shock test for each unit also makes it possible for the manufacturer to claim that "the Shockmaster can't break down electrically".

(Circle No. 13 on Reader Service Card)

Battery Booster Kit

Borroughs Tool and Equipment Corp. has introduced a new "Battery Booster Kit" to help servicemen solve "dead car" problems.

The outfit includes a Tote Cart equipped with two 7" rubber-tired

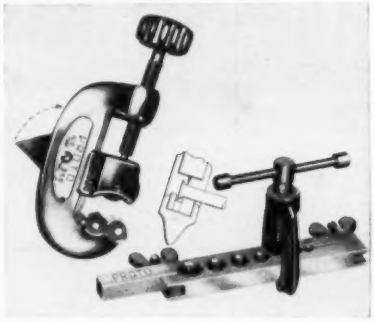


wheels, long tubular handle and 7¼" x 14" battery or battery box platform; A 11" x 14" x 7¼" battery box equipped with hinged lid and two snap locks on front, as well as large carrying handle atop the lid; battery tongs for lifting battery quickly and easily without damage to terminals; and terminal clamps, battery clamps and cables, which are carried under the battery box handle when going to or from location.

(Circle No. 14 on Reader Service Card)

Tubing Service Tools

A new tubing cutter, designed to handle metal tubing or conduit from ⅛" to 1⅛" O.D., is announced by the Proto Tool Co. The husky screw and alloy frame, plus scientifically heat-treated alloy steel blade is said to



give clean, fast cuts and long service. Roller anvil has special groove to permit cutting next to flared tubing ends for greater tubing economy.

Also announced by Proto is a complete flaring tool with slip-on yoke, designed for tubing from 3/16" through ⅝" O.D. Flaring yoke is malleable iron of proper toughness; tapered cone is hardened and polished, and rides on a ball-bearing.

(Circle No. 15 on Reader Service Card)

Adjustable Lower Ball Joint

A new, adjustable lower ball joint unit for installation on 1955 through 1957 model Chevrolets, is being offered by Carlson Mfg. Co. for eliminating dangerous front end looseness,

hard steering, noise and excessive tire wear.

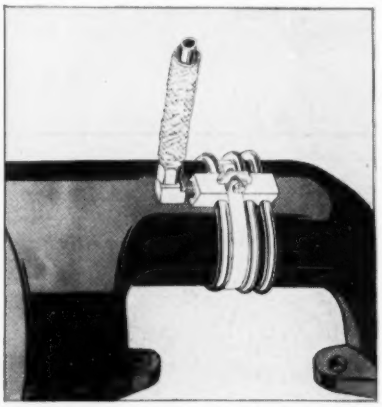
The unit is lubricated through a standard grease fitting and a special gasket between the two major housings gives a complete seal for retaining grease. Both right and left hand units are available.

Similar units are available for installation on Cadillac, Buick and Pontiac cars.

(Circle No. 16 on Reader Service Card)

Heat Riser Tube Kit

A heat riser tube replacement kit is announced by the Wohlert Corp. for easily and quickly replacing broken or plugged-up automatic choke heat tubes. The heat conducting tubes lay next to the manifold and pick up heat and transfer it to the air flowing through a trap. This air passes through



the trap, is heated and drawn up through the insulated tube by a vacuum effect of the automatic choke.

The kit is furnished complete with a self-tapping screw and steel clamp which does away with drilling into manifold or cross-over pipe—the clamp is merely fastened to or around the manifold. According to the manufacturer only one set is needed for coverage on all cars and trucks, and the original heat tube does not have to be removed.

(Circle No. 17 on Reader Service Card)

Valve Stem Oil Seals

Valve stem oil seals, designed especially for use on Chevrolet 265, 283 V-8's and Sixes, are available from Rennicks Company, who claims the

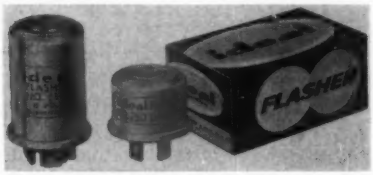
seals will stop excessive oil consumption caused by oil passing either intake or exhaust valves.

Installation of the kits requires no special tools or machining, nor is removal of the heads required.

(Circle No. 18 on Reader Service Card)

Signal Flashers

A new line of directional signal flashers has been announced by the

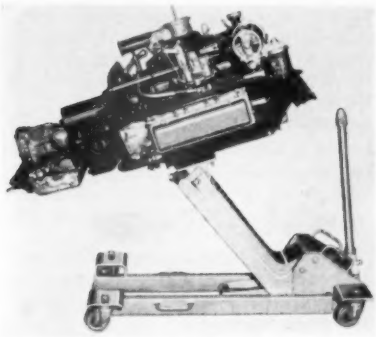


Ideal Corp., who states that nine units provide full coverage, with five of these units covering 95% of all cars on the road today.

(Circle No. 19 on Reader Service Card)

Adapter Speeds Corvair Service

The new Ausco Corvair adapter provides a safe, convenient means for removing and replacing the Corvair engine, differential and power train as a single unit. The adapter is used with Ausco's heavy-duty transmission handler (No.D-8200), supporting the complete Corvair power train at the



engine pan rail as recommended by the Corvair shop manual.

Use of the adapter and transmission handler is said to eliminate need for using twin post or other special lifts. A shop crane or chain lift can be used to raise the rear of the car with regular garage horses then used to support the chassis during engine removal and replacement.

After removal of the power train, repairs can be made while the unit is on the jack which holds the work at a comfortable bench height.

(Circle No. 20 on Reader Service Card)

Blackhawk's "Jack 'n Strap"

A series of new, mechanical body jack sets called "Jack 'n Strap" that can push, pull and brace, is announced by the Blackhawk Automotive Division.

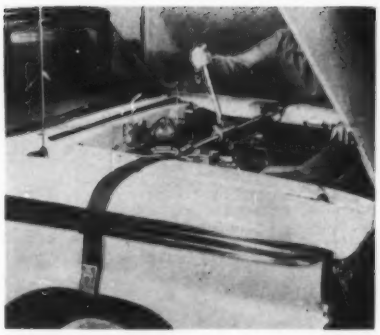
With just two strokes of the handle the jack moves 1¼". It's said to be an extremely practical answer to light sheet metal repairs on fenders, doors, deck lids, hoods and bumpers.

The jack's 1½ ton capacity is more than ample for any light sheet metal repairs or aligning jobs. It is constructed of strong malleable iron with a threaded base that accepts all Blackhawk Bantam Tubing for dozens of applications.

Three Jack 'n Strap sets are offered, all containing the body jack and two non-scuffing web straps for aligning, plus the following attachments: tubing, chain, fender clamp, saddles, Flex Head and 90° "V" Base.

(Circle No. 21 on Reader Service Card)

Say You Saw It In
Automotive Service Digest



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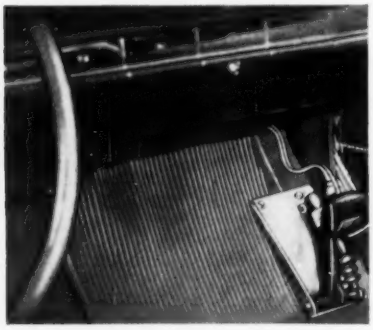
These are new *manufacturers' products*

Dual Brake Control

To facilitate instruction of beginners in driving a car, the Stromberg Hydraulic Brake and Coupling Co. announces the Hydramite Hydraulic



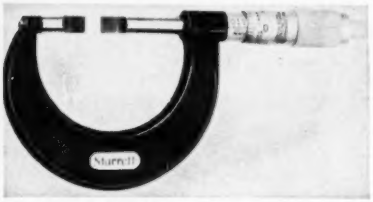
Brake Dual Control—a braking device which fastens to the floor of the front compartment of a car, on the extreme right side, so that the instructor riding with the trainee may place his foot on it and bring the car to a safe stop whenever need be.

The unit can be quickly and easily installed. While it operates just as surely and positively as the regular foot brake, its operation is entirely independent of the regular brake.

(Circle No. 22 on Reader Service Card)

Blade Type Micrometers

A line of micrometer calipers with blade-type anvils and spindles is now offered by The L. S. Starrett Co. for use in measuring depths of narrow



grooves, slots, keyways or recesses, or for measuring diameters between lands, fins or ridges.

The blade type anvil and spindle is only .030" thick and will measure depths up to 5/16". The spindle is non-rotating and will not turn in a slot or roll off a narrow shoulder.

The Series 486 tools are available in five size ranges: 0-1 in., 1-2 in., 1½-2½ in., 2½-3½ in. and 3½-4½ in. All are graduated to read in thousandths of an inch with every thousandth numbered for quick reading. A convenient "speeder" on the end of the thimble permits rapid turning of the thimble for fast setting and measuring.

(Circle No. 23 on Reader Service Card)

Rubber Lubricant

"Prestone" Rubber Lubricant, now available from Union Carbide Consumer Products Co., Division of Union Carbide Corp., is said to be excellent for mounting and demounting tubeless tires and tires with tubes. A special rust inhibitor protects against rusted rims.

For under-car lubrication, the lubricant is said to quickly penetrate dirt to remove squeaks in rubber bushings. Applied sparingly, it provides effective lubrication for fan and other drive belts and eliminates squeaks. The lubricant can also be used to clean and beautify all rubber accessories including floor mats, tires, moldings, etc.

(Circle No. 24 on Reader Service Card)

38-Piece Socket Set

A new 38-piece socket set in one-half inch square drive, designed especially for the automotive mechanic, has been announced by the Wright Tool and Forge Co.

The set includes 14 standard sockets, sizes three-eights inch through

one and one-quarter inch; nine deep sockets, sizes nine-sixteenths inch through one and one-sixteenths inch; eight ten-point sockets (for either hexes or squares), sizes three-eights inch through thirteen-sixteenths inch; two inch, five inch and 10 inch extensions; flex handle, universal joint, reversible ratchet and steel hip-roof box.

(Circle No. 25 on Reader Service Card)

HYDRAULIC

SCHWARTZ RAMP HOIST

WITH WINCH

The *easier, faster way* to move wrecks!

DOES AWAY WITH TOWING—SAVES ON LABOR

From coast to coast, profit-wise auto salvage firms are utilizing the sensational performance of the SCHWARTZ RAMP HOIST to pick up and transport wrecks. It's an easy ONE-MAN job! The approach is lowered in front of the damaged vehicle, the powerful winch cable is attached, and the wreck is pulled onto the ramp. The ramp is then hydraulically lowered into place and you're on your way.

The SCHWARTZ RAMP-HOIST comes as a complete unit, including all the hydraulic mechanisms, steel or wood ramp with steel approach plate, winch and winch cable, and power take-off pump. In addition, you may have a hydraulically actuated combination rear bumper and trailer hitch.

- **Mounts without removing truck frame cross member.**
- **Carries up to 14 tons.**
- **Fits all trucks 84" to 174" cab to axle.**
- **Hydraulic controls at *the side* of the ramp to give operator unobstructed view of operations.**
- **Exclusive hydraulically controlled hold-down automatically locks ramp.**

For complete information, write Dept. RH-5

DESIGNED FOR SINGLE OR TANDEM AXLES. ALL MAKES OF TRUCKS.

SCHWARTZ Manufacturing Co.

Lester Prairie, Minn.

Compression Testing Set

The new Rimac "Corker" unit, recently announced by Rinck-McIlwaine, Inc., features specially designed expandable neoprene fittings and interchangeable stems for quick, easy, accurate compression checking on all engines, including the latest high compression types.

Once the neoprene fitting is inserted in the spark plug hole, the mechanic

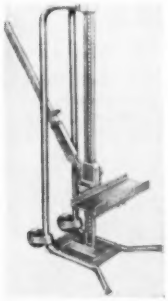
hand tightens the knurled take-up screw on the stem barrel, which causes the "corker" fitting to expand, effectively seal the hole, and lock into position until untightened. With the "corker" fitting holding tight to take the pressure kick, the mechanic does not have to hold the unit in the spark-plug hole with his hand.

The set, mounted on wallboard, includes a compression gauge calibrated to 300 psi, with check and release valves; two mating stems with 14 and 18 mm expandable neoprene fittings; and a third stem with a tapered neoprene fitting.

(Circle No. 26 on Reader Service Card)

Three Ton Bumper Jack

A 3-ton capacity mechanical bumper jack is announced by the Vulcan Mfg. Co., Inc., which weighs only 66 lbs. so that it can be easily lifted in and out of service trucks.



Its mechanical design is simple, fast, dependable and offers a lifting range of up to 42" from a low of 5". An extra wide, 16" lifting jaw is said to be extra safe and non-damaging to bumpers. The lifting jaw raises to the work with a "zip" without tedious jacking and automatically drops away from the work the instant weight is removed to speed disengaging time.

(Circle No. 27 on Reader Service Card)

Jumper Wire Set

A set of jumper wires, especially designed for general automotive applications, is announced by the Kennedy Service Tools Co. The set consists of three wires: one black, 32" long, one red, 32" long and one yellow, 42" long. The set also includes two utility clamps all packaged in an attractive clear plastic case.

(Circle No. 28 on Reader Service Card)

Salesman, Serviceman, Counterman or Chief . . . in thousands of establishments, busy hands reach for **EIS Brake Parts** . . . and for good reason: every part in **"The Brake Parts Line"** is engineered with a single objective . . . to do the job better and more profitably. No dust-catchers here . . . just fast turnover and that's what adds up!

"E" Series HRC* WHEEL CYLINDER CUPS with Expanders and Springs.. *BUILT INTO EVERY EIS WHEEL CYLINDER..INCLUDED IN EVERY EIS WHEEL CYLINDER REPAIR KIT!*

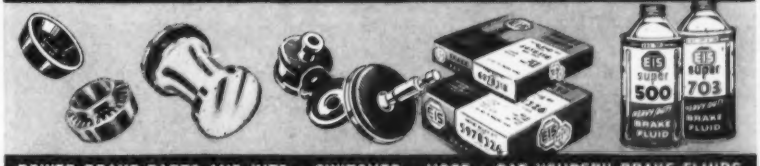
Why? Because since 1956, expander-type cups have been initial equipment on 70% of American cars (including Cadillac and Imperial)!

"E" Series CUPS represent one of the many product-developments that have established EIS as THE Brake Parts Line! They're recommended for all wheel cylinder work and are available in all sizes.

* Heat-Resisting Compound

MASTER CYLINDER AND KITS · WHEEL CYLINDERS AND KITS

PLAIN CUPS · FILLER-TYPE CUPS · RIBBED CUPS · RIBBED SECONDARY CUPS



POWER BRAKE PARTS AND KITS · SWITCHES · HOSE · SAE "SUPER" BRAKE FLUIDS

Write for catalog. EIS AUTOMOTIVE CORP., Middletown, Conn.

At the IASI SHOW ..... BOOTHS 2546-2548-2645-2647

Literature:

manuals, catalogs and charts

most items are yours for the asking

ACILLOSCOPE MANUAL . . . AC's 44-page manual contains more than 100 illustrations, together with explanations, on the use of the new ACilloscope spark plug tester. Divided into five sections, the manual covers: (1) Instructions for operating the ACilloscope; (2) Inspecting and servicing spark plugs; (3) Removing and replacing spark plugs, including pictures and a discussion of the special problems encountered in some makes of automobiles; (4) Seven easy steps to minor tune-ups; (5) Special AC service aids and tools.

(Circle No. 29 on Reader Service Card)

POWER TIMING LIGHTS . . . A giant size wall poster being offered by Auto-Test, Inc., contains eye-catching cutaway illustrations showing construction features of their Mark IV Power Timing Light.

(Circle No. 30 on Reader Service Card)

SOLDERLESS TERMINALS . . . Latest ETC, Inc., bulletin shows a wide choice of basic types of electric terminals and connectors for use in wiring applications ranging from the "ring" and other standard tongue designs through multiple-wire connectors and quick-disconnects. Five barrel styles are illustrated, including insulated, non-insulated and vibration-proof styles, with performance features of each compared.

(Circle No. 31 on Reader Service Card)

SOLENOIDS . . . Arrow Armature Co's Solenoid Switch Catalog (No. 159) lists new and rebuilt solenoids for most models from 1942 to 1959 including passenger cars, trucks, buses, and tractors.

(Circle No. 32 on Reader Service Card)

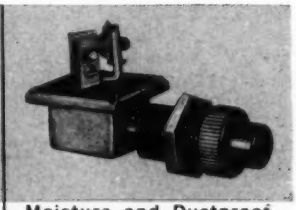
POWER STEERING HOSE . . . Exerflex catalog (No. P-659) features a complete alphabetical listing of power steering pressure and return hose assemblies by car make, model and year; a listing by Everflex part number, plus a complete interchange guide from car manufacturers to Everflex and from replacement manufacturers to Everflex.

(Circle No. 33 on Reader Service Card)

Polarized Four-Pole Trailer Connector Assembly for Passenger Cars.

Underwriters' Laboratory Approved Toggle Switches With or Without Wire Leads.

Complete Electrical Control Switch Panel for Electric Starting Requirements.



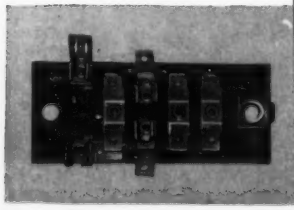
Moisture and Dustproof Momentary Starter or Choke Switch.

COLE-HERSEE

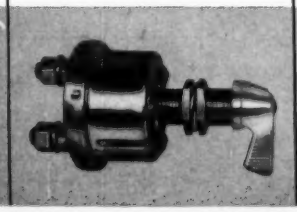
COLE-HERSEE CO.
Over 40 Years of Consistently Better Products
20 OLD COLONY AVENUE, BOSTON 27, MASS.

Quality AUTOMOTIVE and TRUCK ELECTRICAL PRODUCTS

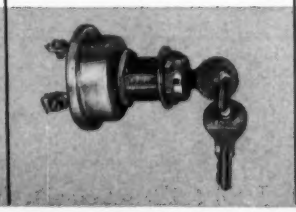
Terminal and Fuse Blocks With Fast Slip-On Type Terminals.



Battery Master Disconnect Switches. Single and Double-Pole Versions.



Combination Ignition Starter Switches With Coded Tumbler Lock and Keys.



Pilot Lamps — Gasketed, Waterproof With Clear or Red Faceted Lenses. Single or Double Contact. 6, 12 or 28 volts.

IASI SHOW — NEW YORK COLISEUM — FEBRUARY 10-13, 1960
We'll be on the 3rd Floor, opposite the elevator, Booths 3402, 3404.

You may want this information, and most of it comes to you free. Just circle the key number on the Reader Service Card corresponding to the one that appears with the editorial review. Our Reader Service Department will forward your inquiry to the manufacturer or supplier for attention.

MACHINE SHOP SERVICES . . . Van Norman's latest 62-page catalog (No. 55) contains complete descriptions and details of shop equipment needed for cylinder head resurfacing, crankshaft grinding, valve work, cylinder work, piston work, brake drum turning, etc. —in fact, just about every piece of equipment to be found in today's modern, up-to-date automotive machine shop. Send for your free copy today.

(Circle No. 34 on Reader Service Card)

OVERHEAD DOORS . . . 4-page color folder announces new line of overhead type doors being offered by Barber-Colman. Gives full information on new Weather-King Flush sections, which combine high-insulation-valve, sandwich construction with guaranteed weatherproof facings. Also described and illustrated are electric operators and special controls.

(Circle No. 35 on Reader Service Card)

FINISHING SYSTEMS . . . Illustrated DeVilbiss Company folder (Form F-325) contains complete selection of all equipment items needed for a fully integrated finishing installation with each component engineered to work together. Included are spray guns, automatic spray coaters, flow and dip coaters, industrial ovens, air compressors, dust collectors, spray booths, industrial power washers, hot spray systems, paint tanks and pumps, hoses and connections and phosphatizing systems.

(Circle No. 36 on Reader Service Card)

GASOLINE CONTAINERS . . . A six-page, four-color catalog illustrates and describes the 1960 line of gasoline containers, tanks and accessories, being offered by The Alva T. Smith Co. for use in re-fueling boats, automobiles, chain saws, power mowers, and miscellaneous gasoline-powered equipment.

(Circle No. 37 on Reader Service Card)

CON-ROD FAILURES . . . A new 24-page pocket size booklet on the causes of con-rod bearing failures and how they can be prevented, is now available from Sunnen Products Co. Entitled *Why Recondition Rods*, it fully illustrates and describes why and how rods should be reconditioned to insure trouble-free bearing insert performance and provides interesting data on the history and progress of bearing development.

(Circle No. 38 on Reader Service Card)

MUFFLERS . . . The 1959 Pratt Muffler Division's 12-page dealer catalog (FormNo. 828) includes a comprehensive index of the division's muffler, tail pipe and exhaust pipe numbers in addition to a complete page illustrating colorful merchandising helps.

(Circle No. 39 on Reader Service Card)

BRAKE LINING . . . New 8-page catalog gives condensed listings with Grey-Rock recommendations for all passenger cars, including 1959 models, and popular light trucks. It shows Grey-Rock brake lining numbers for those cars and trucks for dealers equipped to do their own riveting or bonding. It also contains Grey-Rock recommendations for bonded lined

(*Continued on page* 58)

Calendar of Automotive Events

1960

Jan. 16-24—52nd Annual Chicago Auto Show International Amphitheatre, Chicago, Ill.

Jan. 21-23—A.E.A. Regional Conference, Atlanta Biltmore, Atlanta, Ga.

Jan. 25-28—33rd Annual National Auto Accessories Exposition, Navy Pier, Chicago, Ill.

Jan. 28-30—A.E.A. Regional Conference, Hotel Sherman, Chicago, Ill.

Jan. 30-Feb. 3—National Automobile Dealers Association Annual Convention and Equipment Exhibition, Shoreham Hotel, Washington, D. C.

Feb. 7-9—Automotive Affiliated Representatives Meeting, Manhattan Hotel, New York, N. Y.

Feb. 10-13—Automotive Service Industries Assn. Show, Coliseum, New York, N. Y.

Feb. 17-22—10th Annual Autorama, Connecticut State Armory, Hartford, Conn.

Feb. 18-20—A.E.A. Regional Conference, Multonomah Hotel, Portland, Ore.

Feb. 29-March 2—A.E.A. Regional Conference, Statler Hilton, Los Angeles, Calif.

March 10-13—Pacific Automotive Show, Denver City Auditorium, Denver, Colo.

March 24-27—Southwest Automotive Show, Dallas, Texas

June 1-4—Automotive Engine Rebuilders Assn. Annual Convention, Netherland-Hilton Hotel, Cincinnati, Ohio.

Harvey Jones says: "The radiator business was new to me until I opened my shop. During the first 9 months I grossed $18,000! I feel this was due to the excellence of my Inland equipment — plus the instruction and sales aids received at your school!"

Douthit-Carroll-San Chez Co., Memphis, Tenn., averages $300 a week!
Sidney Glass & Rad. Shop, Sidney, Mont., grossed $10,784 in a year!

WANT EXTRA PROFITS? There's a real radiator-servicing opportunity in your area right now — it's growing every day. Every auto-truck-tractor owner is a prospect. Modern cooling-system pressures now are so great that radiators require more frequent servicing.

Inland, world's largest radiator servicing equipment mfgr., offers equipment, training, Pays-For-Itself purchase plan — advertises nationally (Post and Life) to attract radiator servicing business to Inland-equipped shops. Mail coupon today.

INLAND MFG. CO.
1108 Jackson St., Dept. AD-1 Omaha 2, Nebr.

FREE TRAINING SCHOOL
Factory school trains you or your men quickly: cleaning, repairing, recoring, resectioning, everything!

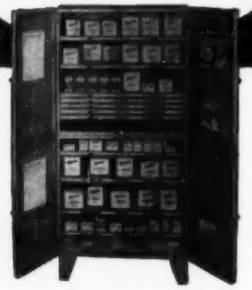
"SOLD EXCLUSIVELY BY MAIL"

WRITE

INLAND MFG. CO., Dept. AD-1 1108 Jackson St., Omaha 2, Nebr.
Please send new free book, "Blue Print For Profits."

FIRM _____ (PLEASE PRINT)
ADDRESS _____
CITY _____ ZONE ____ STATE _____
BY _____ TITLE _____
If dealer, make of car sold _____
Are you now operating a radiator dept.? ☐ Yes ☐ No

Your best connection starts with Shurhit

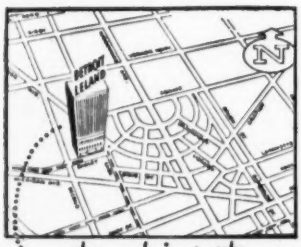


Ignition work is BIG BUSINESS and for those shops doing volume tune-up work here is SHURHIT'S new "MASTER" Ignition Cabinet No. FC425. It takes up less than 2½ sq. ft. of floor space yet stores a complete stock for complete ignition service work on passenger cars, trucks, foreign cars and small engines. Write for Catalog No. 95.

Shurhit Quality IGNITION

Shurhit PRODUCTS, INC.
Waukegan, Illinois

WORLD'S FINEST IGNITION



...center of importance in **DETROIT**

- 800 fine rooms with bath, radio, TV
- Grenadier Dining Room and Lounge
- Coffee Shop
- Convention Facilities
- Ample Parking

Lanson M. Boyer, Gen. Mgr.

DETROIT LELAND HOTEL
CASS AVE. AT BAGLEY
DOWNTOWN DETROIT 26, MICHIGAN

Literature... CONTINUED

shoes and riveted lined shoes for each make and model, available on a shoe exchange basis through Grey-Rock distributors and jobbers.
(Circle No. 40 on Reader Service Card)

REPLACEMENT CAPS . . . Catalog No. 52, being offered by Wayne Metalcraft Div., E. Edelmann & Co., illustrates and describes company's six cap lines, including radiator pressure caps, locking gas caps, stainless steel gas caps, fenderwell gas caps, oil filler caps and standard radiator caps. Five pages of application charts list every type and model with car applications for quick, easy reference. Also given are packaging and merchandising ideas.
(Circle No. 41 on Reader Service Card)

GIRLING BRAKES & SHOCKS . . . 20-page catalog and price list available from Lucas Electrical Services, Inc., covers Girling brake and clutch supply tanks, lined brake shoes, brake parts, service kits, disc brakes and shock absorbers used on many British and other imported cars.
(Circle No. 42 on Reader Service Card)

AUTO LAMP CHART . . . One feature of General Electric's 1960 Auto Lamp Chart is the identification of all makes and models of cars on which the G-E Suburban headlamps can be used; another is the cross reference index of lamps that can be used on foreign cars; a third is the listing of the ten most popular foreign cars; and the fourth is the listing of all lamps used in all domestic cars (including the Corvair, Valiant, and Falcon) plus those used in the more popular trucks.
(Circle No. 43 on Reader Service Card)

MUFFLER POSTER . . . being offered by Maremont Muffler Div., has been designed expressly for installers in states which require inspections of exhaust systems. Properly displayed, this 13" x 18" inspection reminder display poster should create additional sales for all exhaust system parts installers.
(Circle No. 44 on Reader Service Card)

BUSINESS RECORDS . . . "How to Read Your Business Records," available from The Ideal System Co., is written to help businessmen who have little or no understanding of bookkeeping. It explains in digest form how to understand the six basic sections of their business records: sales, expenses, accounts receivable, accounts payable, profit or loss statement and financial statement. It suggests what to look for among these figures, how to recognize danger signs and what to do about them.
(Circle No. 45 on Reader Service Card)

INFRA-RED HEATING . . . New 16-page pocket-size booklet is available from The Panelbloc Div., Bettcher Mfg. Corp. on infra-red heating of industrial and commercial buildings. The booklet gives a simple explanation of what infra-red heating is, and illustrates, with formulas and equations, various methods of calculating infra-red requirements.
(Circle No. 46 on Reader Service Card)

1960 CAR COLORS . . . A 17" x 22" wall chart (No. 26 Vol. 4) is offered by Ditzler Color Div. of Pittsburgh Plate Glass Co. to aid paint shops in identifying colors on the 1960 automobiles. Chart shows location of paint code tags, lists car manufacturers paint code numbers, color names, and Ditzler codes to assist painter in making quick and easy color identification.
(Circle No. 47 on Reader Service Card)

LUBRIPLATE . . . Two colorful new catalog sheets are now available from Fiske Brothers Refining Co., Inc., manufacturers of Lubriplate, one covering Lubriplate Automotive chassis lubrication, crankcase oils and transmission fluids; the other covering Lubriplate's packaged products for resale in both automotive and marine lines. Given in the literature is complete product information plus a line up of point-of-sale material and sales aids available.
(Circle No. 48 on Reader Service Card)

AUTO GLASS . . . The Shat-R-Proof Auto Glass Parts Catalog for 1960 contains complete glass specifications for all American cars and trucks, as well as glass lists for foreign vehicles. In addition to the alphabetical listing, the catalog offers an interchangeable parts section which itemizes the makes and models of all the automobiles that can be fitted by each pattern number. Also included is an easy-to-use safety glass area chart, as well as a brief, informative review of the three types of auto glazing material.
(Circle No. 49 on Reader Service Card)

TEST EQUIPMENT . . . Quick-reference, pocket-size catalog illustrates and describes the time and work saving testing equipment available from Auto-Test, Inc.
(Circle No. 50 on Reader Service Card)

SOLDERING SUPPLIES . . . Catalog available from Johnson Mfg. Co., Inc., contains complete descriptions of fluxes, solders and supplies for all soldering applications. Products shown include general purpose, stainless steel, aluminum, rosin and non-corrosive fluxes, paste solders, tinning compounds; silver brazing fluxes; aluminum and stainless steel solders, as well as soldering accessories.
(Circle No. 51 on Reader Service Card)

BRUSHING UP ON THOSE EASY-TO-FORGET THINGS

Refresher course

✔ *Generator cut-out*

• IF A GENERATOR were connected directly to a battery there would be no way of preventing the battery from becoming discharged when the generator is stopped. The battery current would pass through the generator winding and back to the battery.

Some means must be provided to connect the generator to the battery when the generator starts operating and as it keeps operating. Likewise, the generator must be separated from the battery when the engine is stopped.

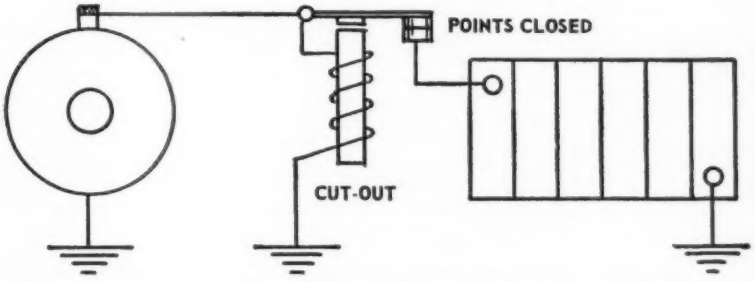


Diagram showing cut-out between generator and battery. When generator stops, the cut-out points open, thus preventing battery discharge through generator.

The unit which does these two things is the cut-out, a simple automatic switch, which, while it's generally placed in the voltage regulator group, has nothing to do with voltage control.

The cut-out operates very simply. As the generator operates it sends current through the cut-out winding, making it an electro-magnet and which attracts the armature to close the points. This allows current to flow from the generator to the battery.

Stopping the engine—and generator—stops the current in the cut-out winding; it ceases to be an electro-magnet, the points open and, of course, the current cannot pass from the battery through the generator windings.

New Tools by KEN TOOL

FLANGE TYPE REAR AXLE PULLER

P-60

Attaches to any standard wheel-puller . . . to pull any flange-type rear axle on late model cars and trucks. Delivers a powerful blow to jar loose the tightest axle shaft.

A MUST FOR EVERY GARAGE!

P-60A

COMBINATION SET

P-60 Adaptor attached to Ken-Tool T-500 Universal Puller. Pulls flange-type axles quicker—easier!

NEW UNIVERSAL DRAIN WRENCH

G-13

NEW 7-way wrench, for all late model cars. The only drain-plug wrench with two 5/16" hex for newest Chrysler cars.

Quick delivery from your local jobber

NEW BATTERY TOOLS

Sold as kit or separately.

B-26 B-207 B-24

B-26 2-in-1 post cleaner and cable spreader and cleaner. B-207 Chrome nickel Plier. B-24 New super-Grip Terminal Puller. B-25 Complete 3 tools in carrying case.

KEN-TOOL MFG. CO.
AKRON 5, OHIO

AUTOMOTIVE REPAIR
COST BOOKS
national
automotive parts & labor
manuals

make sure profits on every automotive repair job. Eliminate money losses and loss of customers. Always have:

PARTS COSTS—the latest official factory prices for **all** replacement parts.

LABOR TIME—official manufacturer's time or accurate, dependable National Time Study figures.

Collision—Chassis Mechanical section. Exploded, detailed views, cross indexed, arranged in logical sequence for making factual cost estimates.

DOMESTIC CARS EDITION

Every car (make and model) past eight years, includes Chevrolet and Ford TRUCKS. Complete service: Master Manual plus monthly price revision service for entire year only $21.00.

IMPORT CARS EDITION

Gives same data for most popular selling American Import Cars with regular revision service for one full year only $14.00.

Buy both deduct $1.00
30 DAY TRIAL REFUND

NATIONAL MARKET REPORTS, Inc.
900 South Wabash Avenue
Chicago 5, Illinois

Renault Announces Caravelle In Bid for Top Import Spot

Mid-December saw the unveiling of Renault's bid for undisputed first place in the American import car field —the Caravelle. The sporty looking car will be available in three models—a hard-top coupe, a soft-top convertible, and a convertible with a detachable hard top which also will carry a soft top as standard equipment. All are two-door models and carry four passengers.

The Caravelle engine, a development of the standard Dauphine 32 hp. engine, produces 40 hp. and is said to be the most powerful ever produced by Renault for a passenger type vehicle imported to this country. Gasoline economy is expected to be as good as that of the Dauphine. Like the Dauphine, the Caravelle is a rear-engine car.

Both three-speed and four-speed transmissions are available, the latter as optional equipment. The Ferlec automatic clutch is optional equipment with the three-speed transmission.

A new suspension system, designed to give "big-car riding comfort," is used in the Caravelle. Known as the "Aerostable" suspension system, it combines conventional coil springs and shock absorbers with unique rubber pads and pneumatic bags that vary the flexibility of the springs according to the load or the impact transmitted from the road.

Properly Installed Filter Will Prevent Oil Leakage

Oil leakage between the oil filter cartridge and the base of the oil filter can occur if the filter cartridge is improperly installed.

Studebaker-Packard Corp. recommends the following procedure for installing oil filter cartridges so as to prevent oil leakage.

First, examine filter base plate for cracks or damaged threads; if plate is cracked, or if threads are not in good condition, replace the base plate assembly.

Lubricate cartridge-to-base plate rubber gasket with engine oil or Lubriplate. Then install a factory approved cartridge and the lubricated gasket, threading the cartridge down onto the gasket surface and *tighten the cartridge securely.* Tightening the cartridge by hand at least ½ turn after the rubber gasket seats on the base should provide sufficient torque. *Do not cross thread.* Should this occur, a new base plate must be installed.

Water Leakage

According to a recent Willys Service Letter, water leakage around the vacuum windshield wiper shaft, on Model DJ-3A with enclosure, may be prevented by installing a rubber grommet.

To do this, redrill the shaft hole in the windshield frame to ½" diameter and install grommet (Part No. 818870) in the enlarged hole and reinstall the windshield wiper.

Compressed Air Found More Effective When Cleaning Paper Air Filter Elements

When servicing the paper carburetor air cleaner filter elements used on 1957, '58 and '59 Chrysler products, the factory advises that tests have shown that the use of compressed air to clean the filter element provides a more effective method of removing excess dust and dirt from the filter without the possibility of damaging the seals or damaging the paper. Their recommended procedure is as follows:

1. Remove the filter element from air cleaner housing.
2. To remove loose dirt, hold air nozzle approximately two inches from the inner screen and blow outward through the filter.

The factory warns against tapping these filters to loosen the grit, nor should they be immersed in fluid. Tapping the filters may possibly result in damage to the element seals or damage to the paper.

Under normal driving conditions, clean carburetor air filter elements at least every 5,000 miles and install a new MoPar filter element every 15,000 miles.

Breaker Points——Keep 'em Clean

Although it usually is advisable to install new breaker points when performing work on a distributor, it sometimes is necessary to service the old ones due to an emergency or lack of the correct replacement parts.

When working on the points, be sure to use crocus cloth as the buffing agent. Sandpaper or other abrasives may damage the contact surfaces and leave minute particles of abrasive in the distributor.

After re-installing the points, clean them thoroughly with a strip of lint-free tape moistened with ether or an equivalent solvent. Pull the tape back and forth across the contacts to remove foreign material. Then, repeat the process with a dry cloth (be sure it's lint-free) to remove all residue and moisture from the contact surfaces. Taking the time to perform this operation will pay dividends in longer point life—since one of the major causes of breaker point oxidation is improper cleaning.

New points, too, always should be cleaned after installation.

If plagued with excessively contaminated points (after checking voltage regulator, ignition starting by-pass circuit and the ohmage of the coil resistor), look for a worn distributor driveshaft bushing. A worn bushing may be letting oil fumes from the oil breather enter the distributor through the distributor cap vents. Also, using the wrong grade of cam lubricant may result in point contamination, especially if the lubricant melts out at high temperatures.

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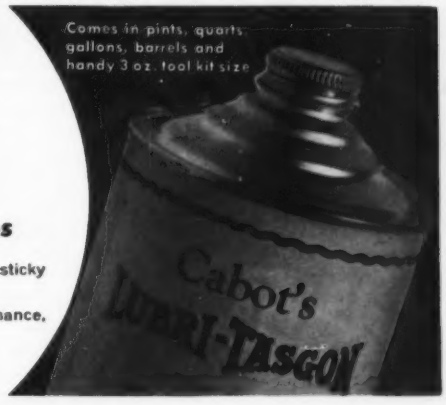

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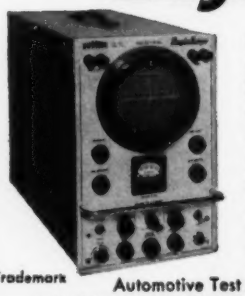

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*Trademark

Automotive Test Equipment Division
ALLEN B. DU MONT LABORATORIES, INC.
750 Bloomfield Ave., Clifton, N. J.

Mayhem in the Mill . . . *(Continued from page 36)*

Wild Ping: This phenomenon of combustion is a take-off of knocking surface ignition, and produces sharp cracking sounds in bursts. To date, not too much is known of the causes and control of wild ping. Most chemical engineers believe wild ping results from early ignition of the fuel-air charge by loose deposit particles present in the combustion chamber. This is supported by the fact that the ping disappears when the particles are exhausted and reappears when more particles break loose from combustion-chamber surfaces. Wild ping is identified as being a form of surface ignition knock characterized by one or more erratic sharp cracks.

Rumble: This type of abnormal combustion produces a low-pitched thudding noise and is accompanied by engine roughness. The sound is not ordinarily associated with combustion. When first heard, it is erroneously diagnosed as mechanical failure of the engine. Rumble is peculiar to modern high-compression engines, and is a comparatively recent form of abnormal combustion. Ordinarily, rumble cannot be controlled or eliminated by using gasoline of higher octane number. This is true, of course, unless the rumble results from surface ignition due to knock.

Rumble is most likely to occur when the engine is accelerated at wide-open throttle. The noise has been described as similar to the sound produced by a stick being pulled along a picket fence. It is a comparatively low-frequency noise in the range of 600 to 1200 cycles per second. Knock, as opposed to rumble, occurs in the frequency range of 4,000 to 6,500 cycles per second. Rumble becomes a serious combustion problem as engine compression ratios are increased above 9.5:1. It is not uncommon for rumble and knock to occur in the same engine cycle. It is thought that the presence or absence of knock depends upon how surface-ignited flame fronts consume the fuel-air charge. If the sources of these flame fronts are so located that the flames consume all the fuel-air charge rapidly, the end-gas will not have time to go through knock-producing reactions before it is consumed. Conversely, as a portion of the charge in the combustion chamber is not burned soon enough, it may go into knock.

Rumble occurs more often after the car has been operated for some time under light-duty conditions, such as in city traffic. Fuels with higher octane numbers have little effect on rumble. However, a phosphorus fuel additive can, to some extent, reduce rumble in high-compression engines.

Run-On and Runaway Surface Ignition: These are two areas of surface ignition that may or may not be accompanied by audible noise.

Run-on—engine continuing to run after the ignition is turned off—is usually caused by the fuel-air mixture being ignited by glowing combustion cham-

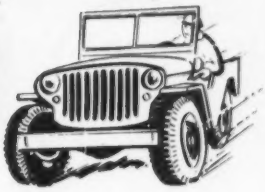
ber deposits. Runaway surface ignition—glowing deposits igniting each fuel-air charge earlier than the preceding charge—is the most destructive type of surface ignition. It can lead very quickly to severe engine damage, such as holes in the piston head and broken piston rings and lands.

At the moment, rumble and runaway are among the greatest concerns of engine designers. They are also of prime importance to the car owners. Upon experiencing the sound of rumble, most car owners tend to feel their engines are completely ruined. Fortunately, when an engine does go into a rumble, the driver is startled enough to bring the vehicle to an immediate stop and shut off the ignition. In the case of runaway, little can be done by the driver after he has turned off the ignition.

To make your shop more profitable . . . your time more valuable . . . be sure to read this month's "These Are New" section.

Service mechanics should be close enough to the causes and effects of abnormal combustion to accurately diagnose conditions and suggest corrective measures. When no cure is present, at least customers tend to feel they are in good hands when their mechanic intelligently interprets current phenomenen of modern, high-compression engines.

GOES LIKE 60



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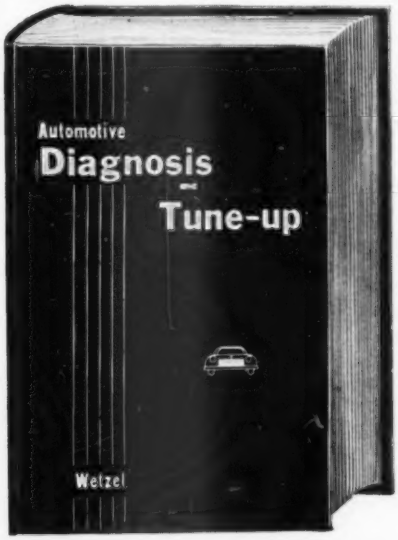

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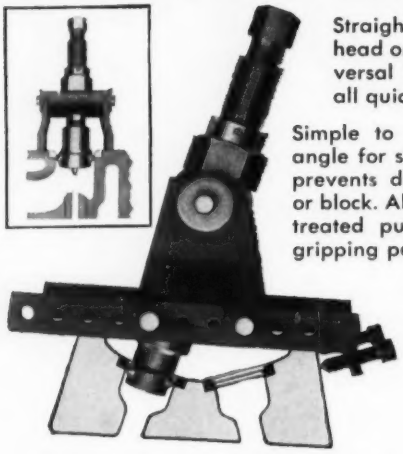

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Grind rods and mains IN THE BLOCK!

The Winona Crankshaft Grinder has been giving fast, accurate service for over 20 years. Now, with the Main Bearing Attachment it will also grind main bearings in the block! A micrometer measuring instrument is available. Now, you can do precision grinding of both main and rod bearings without removing the crankshaft. You can do the whole job in your shop for a better profit and better delivery!

WRITE TODAY *for prices and literature!*

WINONA TOOL MFG. CO.
WINONA, MINNESOTA, U.S.A.

Crankshaft Journals . . .

(Continued from page 18)

ing is proceeding. Make any adjustments necessary for taper and continue grinding.

When the journal is down to within .001" or .002" of the proper size a light stone pressure and slow traverse will have a tendency to load the stone and polish the journal. Quit grinding when you are within .0003" or .0004" of the size desired and use a 240 or 280 grit sanding tape (such as 3-M) and polish the journal dead smooth. A little lubricating oil on the tape helps give an extra smooth finish.

When first starting to grind, don't take too heavy a cut with the stone. Allow it time to grind the journal fairly round and then take heavier cuts. Also, when first starting to grind a journal, dress the stone coarse (that is, a quick pass across the wheel with a diamond point) and as you get down to near size the stone will gradually glaze and load and produce a smooth finish.

A small stone will cut faster because there is less friction.

Try to grind as small a fillet as possible. This will make it easier to fit bearings. This can be accomplished much easier and stone breakdown will be less if the grinder is swung first to one side and the handwheel fed slowly in until the fillet is ground out; then repeating the operation on the other side of the journal. The calibrations on the handwheel will help to determine how far in the grinder has been fed so when the grinder is backed off and the wheel fed in on the other side it will indicate that approximately the same diameter exists on each side of the journal.

Sun's "Satisfaction Guaranteed" Program Designed to Increase Service Volume

Sun Electric Corp. has announced a new "Satisfaction Guaranteed" Expert Engine Service program designed to help automotive service shops get increased service volume through the use of their modern Sun equipment.

Heart of the program is a new 3-color display poster which, when prominently displayed, tells car owners that the shop displaying the poster is in a position to give "Expert Engine Service" with "Satisfaction Guaranteed."

In addition to the new poster and a national consumer advertising campaign, Sun equipment owners will receive a free subscription to the new Sun published magazine "SunRays" containing timely service tips, latest repair trends, and other service information.

For complete details on how to participate in this new volume-building program, circle No. 88 on the Reader Service Card.

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842

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AC Spark Plug Division ... *
American Hammered Division ... *
Arrow Armatures Company ... *
Atomized Materials Co., Inc. ... *
Automotive Brake Components, Inc. ... *
Baldwin Manufacturing Co., J. A. ... *
Barrett Equipment Co. ... *
Bean Division, John ... 51
Bear Manufacturing Co. ... 65
Bergman Tools Mfg. Co. ... *
Bettcher Manufacturing Corp. ... *
Bingham-Herbrand Corp. ... *
Bishman Manufacturing Co. ... 64
Blitz Electric Corporation ... *
Bosch Corporation, Robert ... 7
Brake Parts Specialty Co. ... 23
Branick Manufacturing Co. ... *
Cabot, Inc., Samuel ... 61
Carter Carburetor Division of ACF Industries ... 4
Cedar Rapids Engineering Co. ... *
Champion Spark Plug Co. ... *
Chevrolet Motor Division ... *
Chicago Rawhide Mfg. Co. ... *
Chrysler Motor Parts Div. (MoPar) ... 35
Cole-Hersee Company ... 56
Delco-Remy Division ... 24 and 25
Detroit-Leland Hotel ... 58
Ditzler Color Division ... 37
Dualmatic Products Co. ... 63
DuMont Laboratories, Inc., Allen B. ... 62
Eis Automotive Corp. ... 55
Electric Autolite Co., The ... 2 and 3
F. & B. Manufacturing Co. ... Cover 4
Felt Products Manufacturing Co. ... *
Fitzgerald Manufacturing Co. ... *
Gabriel Company ... *
Golden Glide Shock Absorber Co. ... *
Graymills Corporation ... *
Hall-Toledo, Inc. ... *
Hanson Company, Harvey E. ... *
Hastings Manufacturing Co. ... 12
Hein-Werner Corporation ... *
Houser Engineering & Mfg., Inc. ... *
Hygrade Products Div. ... 47
Ingersoll-Rand Company ... 42 and 43
Inland Manufacturing Co. ... 57
K & W Products, Inc. ... *
Kedman Company ... *
Kem Manufacturing Co. ... *
Ken-Tool Manufacturing Co. ... 59
King Electric Equipment Co. ... *
Lake Auto Radiator Mfg. Co. ... *
Lee Company, K. O. ... *
Lucas Electrical Services, Inc. ... *
Master Technical Press ... 63
McQuay-Norris Manufacturing Co. ... 26 through 31
Milesmaster, Inc. ... *
Miley Company, L. J. ... *
Milwaukee Electric Tool Corp. ... *
Mustang Engines ... *
National Automotive Service ... *
National Brake Block Co. ... *
National Market Reports, Inc. ... 60
Otto Items, Inc. ... 63
Perfect Circle Corporation ... Cover 2
Permatex Company, Inc. ... 1
Phillips Manufacturing Co. ... *
Practical Manufacturing Co. ... 53
Pyroil Company, Inc. ... *
Rajah Company ... 62
Ramsey Corporation ... Cover 3
Rich Manufacturing Co. ... *
Rinck-McIlwaine, Inc. ... *
Rochester Products Division ... 11
Schwartz Manufacturing Co. ... 54
Scranton-Cellomatic Battery Corp. ... *
Sealed Power Corporation ... *
Shurhit Products Company ... 58
Snap-on Tools Corporation ... 32
Standard Motor Products ... 47
Storm-Vulcan, Inc. ... *
Studebaker Taxicab Corp. of Manhattan ... 65
Sturtevant Company, P. A. ... *
Sun Electric Corporation ... 8 and 9
Sunnen Products Co. ... *
Timken Roller Bearing Co. ... 19
Trippe Manufacturing Co. ... 61
Unique Printed Products Co., Inc. ... 61
United Motors Service Division ... *
Wagner Electric Corporation ... 45
Winona Tool Manufacturing Co. ... 64

Firms represented in this issue are indicated by page number. Advertisers in previous issues are indicated by the asterisk.

HE WHO LAUGHS, COME WHAT MAY,

WILL LIVE TO LAUGH ANOTHER DAY

Short circuit smiles

Superintendent: "What we want is a night watchman that will be alert and ready, listening for the slightest noise. Somebody that can sleep with one eye and both ears open, and not afraid to tackle anything."

Applicant: "Keep the job open. I'll send my wife around.

★ ★ ★

A tomcat and a tabby were doing some nocturnal courting on a back fence at the witching hour of midnight. The tom suddenly leaned over and screamed with all the pent-up passion buried within him: "I'd die for you, you beautiful thing!"

The tabby gazed at him through lowered eyelids and purred her reply: "How many times?"

★ ★ ★

The young lion tamer was being interviewed on television.

"I understand your father also was a lion tamer," said the announcer.

"Yes, indeed he was," said the young man.

"And do you actually put your head in the lion's mouth?" inquired the announcer.

"Only once," said the young man, "to look for Dad."

Uncle Jeff (from Oklahoma) once gave a circus elephant a stick of striped peppermint candy. Every year after that, when the circus came to town, the barbers had to hide their poles.

★ ★ ★

Due to the shortage of nurses there was an inexperienced girl on the job. The doctor came rushing into the patient's room.

"Have you kept a chart on his progress?"

"No," she replied with a blush, "but I can show you my diary."

★ ★ ★

After a long, boring evening, the young man finally succeeded in stealing a goodnight kiss from his young lady companion.

"That's your reward for being a gentleman," the girl murmered.

"Reward?" scowled the young man. "That's just workman's compensation."

★ ★ ★

Two grads met at the 20th reunion. One had been on top of the class, the other had a tough time getting his diploma, having had particular trouble with math. The latter seemed to have prospered.

"Joe," said the top man, "you seem to have done exceptionally well. How did you do it?"

"Well," said Joe, "after graduation, I realized I was pretty dumb, and I had better get into some line where I didn't need to be smart like you and some of the others. So I found a product I could make for one dollar and sell to the public for $5.00 and believe me that steady 4% really mounts up over the years.

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Doctor: That pain in your leg is caused by old age.

Grandpa: Don't be silly. My other leg's the same age and it doesn't hurt.

The most worthwhile invention of the age will soon hit the market: Low-calorie hair tonic for fat-heads.

★ ★ ★

A wealthy lady left one of the big London hotels after an evening of eating and dancing at a charity ball. As she stepped into her car, a beggar asked, "Spare me a sixpence, m'lady, for charity. Oi ain't 'ad a bite for three days."

The dowager drew back, exclaiming, "You ungrateful fellow. Don't you realize I've been dancing for you all night."

★ ★ ★

Patient—"Ten dollars is a lot of money for pulling a tooth that just takes a couple of seconds to do."

Dentist—"Well, if you wish, I can pull it very slowly."

★ ★ ★

First Hot Rodder: "What make is your heap, Dad?"

Second Hot Rodder: "It's part Ford, part Chevy, part Pontiac, and part Olds."

First Hot Rodder: "Rather an odd wagon, I'd say."

Second Hot Rodder: "Oh, I dunno. It's kinda understandable—it's mother was a runabout."

★ ★ ★

A scoutmaster, noticing that his recruit scouts were having difficulty organizing their first cook-out, asked whether they had forgotten any essential equipment. "Yes," replied one. "My mother."

★ ★ ★

Turning to her daddy, seven-year-old Barbara asked, "Why doesn't Tommy talk?"

"He can't," replied the father. "Babies as small as he never do."

"Oh, yes, they do," Barbara reassured him. "Why, at Sunday School last week teacher told us that Job cursed the day he was born."

★ ★ ★

This inquiry came to the reservations desk of a resort hotel: "Do you have suitable accommodations where I can put up with my wife?"

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"LOW WALL PRESSURE, QUICK BREAK IN"

"We do a lot of heavy duty work and some engines get a yearly overhaul. This points up the problem of block wear since excessive wear calls for an earlier re-bore or re-sleeve. We've found that Ramco's low wall pressure, chrome-plating and quick break-in are our entire answer. We can often go back with the second or third set of the same size. We are pleased with our results from an operational viewpoint."

Alvin Glace
G & K Auto Truck Service
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Philadelphia, Pa.

"IMMEDIATE OIL CONTROL"

"Oil control from the first minute of operation is a necessity with customers. Most of them don't realize the power loss from worn rings but can really diagnose their trouble by watching the dip stick. With Ramco's immediate oil control, we've earned a lot of good, solid customer satisfaction."

Harold Sloan
Freight Ways, Inc.
1309 N. Mosley
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"SPECIAL, QUICK SEAT IN FEATURES"

"Lack of quick seat in, especially to control compression is more serious than normally realized. A serious blow-by problem doesn't correct itself, and a come-back is sure to result. We insure ourselves against this with Ramco. All these rings have special, quick seat in features."

E. H. Daniels
Union Garage
7304 Harrisburg St.
Houston, Texas

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See us at Booths 2728-30-32-34 at the I.A.S.E. Show, Feb. 10-13th.

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See us at Booths 3905-07 at the I.A.S.I. Show

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